Engineering and Mining Journal

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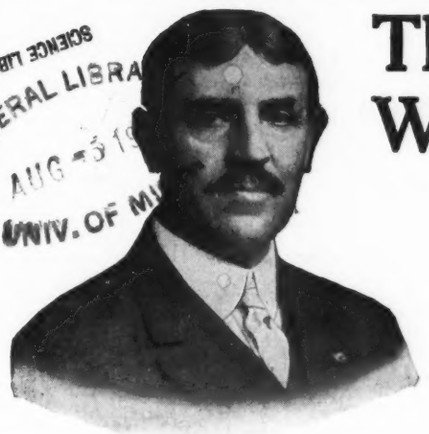

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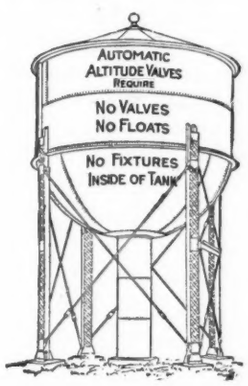

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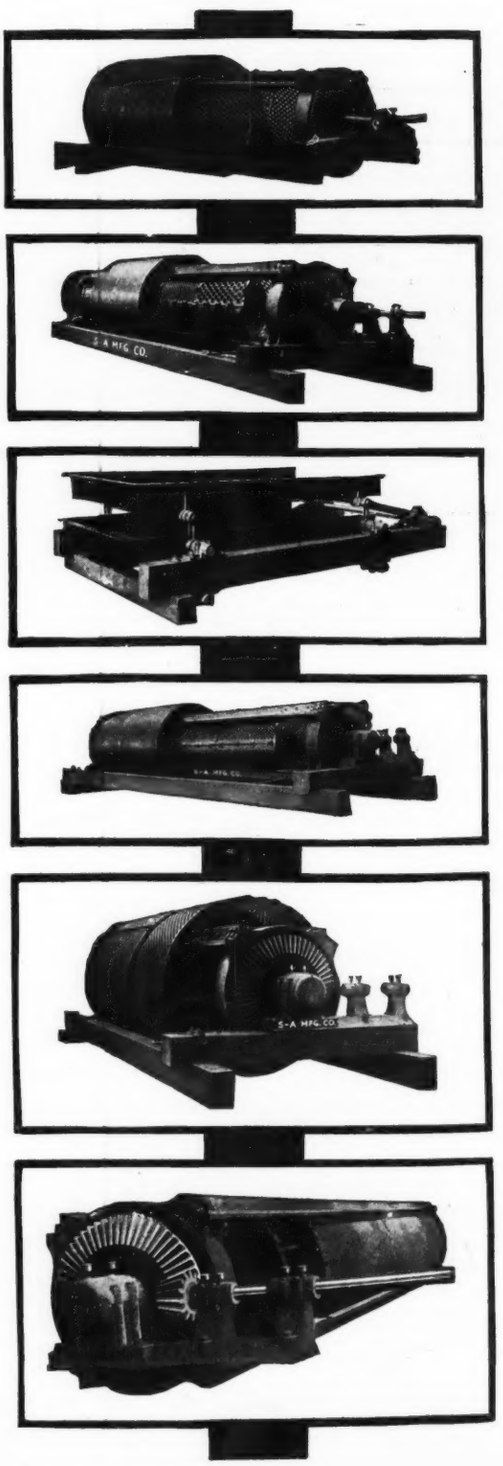

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A MODERN ROAD IN THE DESERT

The Southwest Copper Field

BY J. R. FINLAY*

Statistics show the immense importance of the oval of territory within which are included many of the greatest copper mines. The general characteristics of the section and the climatic variation in mountain, valley, and plain are defined; geologic aspects are described and several theories propounded, and the comparative ethnology of Mexican and American and the economic results of the admixture of races occurring in this region are discussed, with interesting conclusions.

THE greatest copper-producing region of the world may be described as a rough oval of about 40,000 square miles, measuring about 330 miles north and south and 165 miles east and west. Its most easterly extremity is at the Chino mine, near Santa Rita, New Mexico; its most westerly, at Ajo, Ariz.; its most northerly point is Jerome, Ariz., and its most southerly, Nacozari, Mexico. In New Mexico are the districts of Santa Rita and Burro Mountains; in Old Mexico, those of Nacozari and Cananea; in Arizona, those of Bisbee, Ray, Globe, Clifton, Jerome, Ajo, and a number of smaller ones. Thus, much the greater part of the field lies in Arizona, and, as nearly as may be estimated, this area produced 27% of the world's output of copper in 1917, 36% of the production of the two Americas, and an amount equal to 47% of that of the United States. Its actual production is shown in the table on the following page.

The tables do not give an exact comparison of the field under discussion with the other subdivisions of the world, because the whole of Mexico is included, and only a part of that country may properly be considered to be in this field. It is rarely possible for such data to be accurate in all respects; but, with the above explanation, the figures will serve their purpose. They are compiled from statistics published in the *Engineering and Mining Journal*, Jan. 12, 1918.

This vast copper region deserves more than a passing description. Geographically it bears considerable resemblance to Spain and Morocco, corresponding fairly well to those countries in latitude and with regard to

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bordering ocean; and, therefore, to a large extent in climate and physical appearance. The central part is in latitude 32° N. and is about 180 miles from the Gulf of California. The region is arid to semi-arid, the rainfall varying from 6 or 8 in. annually at Ajo to 16 or 18 in. at Globe. The climate naturally varies according to differences of altitude, the local topography, which influences rainfall and winds, and, to a minor extent, to difference of latitude. The altitude is from 2000 ft. at Ajo to 6000 ft. at Cananea. A rough average of the whole may be found at Cochise, situated in latitude 32° N. at an elevation of 4250 ft. Here the mean temperature for the year 1916 was 60..5° F., with a maximum of 102° in July and a minimum of 6° in December. The normal precipitation is 11.78 in., but it probably varies in different years between 8 and 16 inches.

The latitude is sub-tropical, and, of course, the district is decidedly warmer than that of the more populous parts of the country; but popular fancy exaggerates the difference. Even Yuma, which is outside this area, practically at sea level, near the mouth of the Colorado River, and celebrated as the "hottest place in the world," or something to that effect, has not even an average tropical heat. The mean for 1916 was only 69.2°, the temperature varying between 110° and 20°. The hottest month, August, had a mean of 86.5°. At the Prescott Dry Farm, at an elevation of 5008 ft., the temperature varied in 1916 between 95° and 7°. At Phœnix, elevation 1108 ft., the extremes were 111° in June and 24° in December, indicating, as compared with Prescott, a difference in the extremes of temperature of about 16° for 3900 ft. of elevation.

TABLE OF COPPER OUTPUT IN POUNDS

State	1914	1915	1916	1917
Arizona	387,978,000	444,089,000	692,630,000	692,924,000
New Mexico	64,339,000	75,515,000	83,013,000	101,952,000
Old Mexico	80,000,000	67,000,000	112,000,000	90,000,000
Totals	532,317,000	586,604,000	887,643,000	884,876,000
Total United States	1,158,582,000	1,423,698,000	1,942,776,000	1,888,396,000
Total Western Hemisphere	1,479,800,000	1,797,959,000	2,429,749,000	2,392,144,000
Total world	2,050,000,000	2,388,540,000	3,099,602,000	3,114,475,000

PERCENTAGE PRODUCED BY ARIZONA, NEW MEXICO AND OLD MEXICO

	1914	1915	1916	1917
Of the United States	45	41	45.7	47.0
Of the Western Hemisphere	36	33	36.5	36.2
Of the world	26	26	28.6	27.8

PERCENTAGE OF WORLD OUTPUT PRODUCED IN WESTERN HEMISPHERE

1914	1915	1916	1917
72.2	75.2	78.4	77

The rainfall comes regularly in two rainy seasons: a winter season, culminating usually in January or February; and a summer season, in July and August. There are usually about five months in each of which the precipitation is one inch or over; in the other seven months the fall is scant. Thus, at Cochise in 1916 the total for the year was 14.69 in., of which 12.99 in., or 89%, fell in the five months of January, July, August, September and October, the other seven months having only 1.70 in, or 11 per cent.

The record of climatic observations at Cochise is given in the twenty-seventh annual report of the agricultural experiment station of the University of Arizona, for 1916, and is shown in the table.

F. L. Ransome, certainly one of the most brilliant of geological writers, has followed the classic example of Cæsar with regard to Gaul by dividing Arizona into three parts—the plateau region, the mountain region, and the desert region. Though the boundaries are in places somewhat indistinct, in general the division is an apt and a true one.

The mines are practically all in the central or mountain belt; but since the conditions of life, in these days of swift and improving transportation, are influenced by the region as a whole, as well as by the immediate local surroundings of the inhabitants, it is not inappropriate to take note of the climate and aspect of the three belts. One cannot but be impressed by the variety of scenes, and perhaps surprised at the inaccuracies of his geography. That was my experience. Having traveled extensively in the United States, sometimes upward of 40,000 miles a year, I had fallen into the conceit of assuming that I knew the country. Travel had become a bore, and I had even come to feel interested only when I could get off the train; and I looked out of the windows solely because there was nothing else to do. Probably many like myself get into a rut of preoccupation and fail in a similar way to get satisfaction out of their opportunity, or through the necessity of travel. To find a place interesting is to be interested. Many mining men are of broad intelligence, able to take a big place in the world's affairs, as Mr. Hoover has, but I think there are many who see little in a mining country except the mines.

TEMPERATURE AND PRECIPITATION—SOUTHWEST COPPER FIELD.

Month	Temperature, Degrees Maximum	Temperature, Degrees Minimum	Temperature, Degrees Mean	Precipitation, Inches
January	71	14	45.2	2.20
February	80	18	51.0	0.48
March	86	28	56.3	0.63
April	89	29	58.6	0.08
May	95	37	64.6	0.28
June	101	42	76.2	0.00
July	102	58	78.0	3.78
August	97	56	75.2	4.10
September	91	43	70.8	1.55
October	86	32	60.7	1.36
November	85	22	49.5	0.00
December	74	6	40.1	0.23
Year	102	6	60.5	14.69
Normal				11.78

There is also a good deal of literature published by fanciful persons who make their product a caricature of local color. From such "authorities" one gains impressions that the unusual is the usual. To quote my own experience once more, I had gained the impression, somehow, that Arizona was a monotonous expanse of dusty desert, sparsely covered with greasewood and grotesque cacti, relieved only by an occasional sandy wash where there would be streams if there were any water, and by lonely bare mountains well scorched by the sun. There are such stretches in Arizona, but they serve only to help give the state some of its variety and interest.

Northern Arizona Plateau Land

The great Coconino plateau of northern Arizona is said to contain the largest reserve of uncut pine timber in the United States. Above it rise the San Francisco peaks, volcanoes recently extinct, nearly 13,000 ft. high and nearly always covered with snow. Flagstaff, a lumbering town at their base, at an altitude of 6900 ft., has a climate like Minnesota. The mean average temperature is only 44°. Its precipitation is greater than that of any place along the California coast south of San Francisco; greater, I believe, than at San Francisco. Government records, not mere rumors, show tem-

peratures as low as 25° below zero, such as are not felt in New York once in a lifetime. This plateau is not a small part of the region, but a very large part, lying immediately north of the mining districts. The U. S. Geological Survey (guidebooks of the Western United States, Santa Fé Route, Bull. 613, a most interesting and instructive volume, by the way) has this to say:

From Isleta, an Indian pueblo on the Rio Grande, which flows into the Gulf of Mexico, the railway begins its long journey across the interesting plateau country, which, with its bordering areas, extends almost to the Colorado River, which flows into the Pacific. This vast area of high, nearly level country lies between the rugged and generally higher ranges of the Rocky Mountains on the north and the alternating short ranges and deserts of the lower-lying north end of the Mexican plateau to the south.

This is a land of varied landscapes, rocks and people. In places the plains and cliffs are vividly colored by natural pigments of red and vermilion. The rocks of the plateau are surmounted by two large volcanic piles, which stand far above the general level of the plain and which were master volcanoes in but comparatively recent time—Mount Taylor on the east and the San Francisco Mountains on the west. From the immensely thick and almost horizontal sediments that compose most of the mass of the plateau, layer after layer has been eroded away over wide areas, leaving remnants of harder strata which make picturesque hills and valleys and expose fossil forests which long ago were buried in the sediments of which these strata are made. Erosion has also carved many canyons, notably the majestic Grand Canyon of the Colorado.

Here and there in the rocky cliffs and canyons are the present and former communal homes of the aboriginal peoples, whose arts and religious ceremonies partly lift the veil of the past and reveal glimpses of the earlier stages of the human culture. These vast expanses were long ago the abode of aboriginal tribes; later they were explored and dominated by the mounted Spanish *conquistadores;* and finally they have been made accessible to all by the comfortable railway of today. The plateau country and its approaches, in all their aspects—geologic, ethnologic and historical—form a region which will hold the attention of all passers-by in whom there exists a spark of appreciation for striking natural phenomena and significant human events.

I quote further from the publications of the U. S. Geological Survey (Professional Paper 98-K, by F. L. Ransome) to get a broader description:

The plateau region, which has an area of about 45,000 square miles in Arizona, occupies the northeastern part of the state and drains generally northward through the Little Colorado and smaller streams into the Grand Canyon. The general altitude of this region, which is a part of the great Colorado Plateau, ranges from 7000 to over 8500 ft. As Dutton graphically states:

"Its strata are very nearly horizontal, and, with the exception of the Cataract Canyon and some of its tributaries, not deeply scored. Low mesas, gently rolling and usually clad with an ample growth of pine, pinon, and cedar; broad and shallow valleys, yellow with sand or gray with sage, repeat themselves over the entire area."

Here and there the Kaibab limestone (Pennsylvanian, late Carboniferous), the prevalent surface rock, is covered by flows of basalt or bears erosion remnants of younger strata; and above it, north of Flagstaff, rise the lofty extinct volcanoes of the San Francisco Mountains.

The southwestern limit of the plateau traverses in a general southeasterly direction from the Grand Wash Cliffs, near the eastern border of Nevada, to the New Mexico line, a few miles northeast of Clifton. This boundary along much of its course is a single bold escarpment 2000 ft. or more in height; but elsewhere it is less definite and less simple, owing to a distribution of the total difference in relief among a series of great topographic steps, or to local accumulations of volcanic rocks, especially basalt. In general, the outer or lower line of cliffs separates nearly horizontal and undisturbed strata on the northeast from faulted and tilted beds on the southeast; and locally, as along the Grand Wash Cliffs, this line is itself a fault scarp, more or less modified by erosion.

The Grand Wash cliffs rise precipitously 3000 ft. or more above the plains to the west. According to Lee, pre-Cambrian granite is exposed at their base and the Redwall limestone forms their crest and the floor of the adjacent plateau. About 45 miles east of the Music Mountains a second gigantic step, that of the Aubrey cliffs north of Seligman, carries the geologic section nearly to the top of the Kaibab limestone, which forms the surface of the Coconino Plateau, south of the Grand Canyon. South of the Music Mountains there is another ample terrace in the ascent from the valleys of the mountain region to the Colorado Plateau—that of the Truxton Plateau. This bench, which lies between the Cottonwood and Aquarius Cliffs to the west and Yampai Cliffs and Juniper Mountains to the northeast, is described by Lee as a granitic peneplain partly covered with volcanic rocks.

South of Ash Fork the continuity of the plateau escarpment is interrupted by flows of basalt that poured down from the plateau to the valley of the Verde, forming a slope that has been utilized by the Santa Fé, Prescott & Phœnix Ry. between Ash Fork and Jerome Junction. East of this railway and north of Jerome the edge of the plateau is in general a scarp (part of the Aubrey Cliffs of Gilbert) over 2000 ft. in total height, with deep reëntrants and bold pinnacled promontories.

Ransome does not stop to say that the view from the mining town of Jerome—itself perched on a steep escarpment 2000 ft. above the valley—across the broad Verde Valley to these red cliffs, topped by a dark line of forest, all surmounted by the towering San Francisco peaks, is nearly, if not quite, as impressive as the Grand Canyon itself.

East of Camp Verde a thick series of basaltic flows, with associated tuffs, has covered the edges of the nearly horizontal sedimentary rocks; but these beds appear again at the head of Fossil Creek and continue eastward past Payson in the great southward-facing cliff that marks the descent of about 2000 ft. from the Mogollon Mesa to the Tonto Basin. From Fort Apache eastward to the New Mexico line, the plateau boundary becomes less distinct. Erosion has partly destroyed its continuity, and vast accumulations of volcanic rock have obscured the original plateau surface.

The second topographic division, the mountain region, which adjoins the plateau region on the southwest, is essentially a broad zone of short and nearly parallel mountain ranges, among which are the Dragon, Chiricahua, Whetstone, Pinaleno, Galiuro, Santa Catalina, Pinal, Superstition and Mazatzal (and many others), extending diagonally across the state from the southeast corner to Colorado River. The width of the zone may be taken as from 70 to 150 miles, but its southwest boundary is not susceptible of precise demarcation. Few of the individual ranges exceed 50 miles in length or 8000 ft. in altitude. Their general trend is almost northwest, but near the Mexican border it becomes more nearly north, and the mountain zone as a whole coalesces with a belt of north and south ranges that extends through New Mexico, thus swinging around the plateau region and bordering it on the east also.

Most of these ranges consist mainly of quartzites and limestones of Paleozoic or earlier age, resting with conspicuous unconformity upon granitic, gneissic and schistose rocks. All these rocks are cut by later intrusives, especially by diabasic and monzonitic rocks, and are partly covered by flows of lava. Structurally these ranges are characterized by the dominant part played by faulting as compared with folding. The great copper deposits of Arizona, so far as they are known, are all, except that of Ajo, within this mountainous zone.

I have quoted these descriptions more fully, especially in the case of the plateau region, than would at first seem relevant to a discussion of the mines, none of which are found in that area. But the contrast of the two areas is of great interest to the mining man because it shows so clearly that the mountain region, in which the mines occur, is a pronounced zone of weakness in the earth's crust. The plateau is like a great floe of arctic ice, through which cracks run at occasional intervals, but on the whole it is solid and uniform. The mountain region resembles a fringe of hummocks bordering the floe, in which great blocks have been broken and tilted, some portions sloping far down below the general level and others jutting their angular edges above it. At three different epochs since the Paleozoic age has this rupturing taken place, and each time igneous molten rock has been squeezed up between and

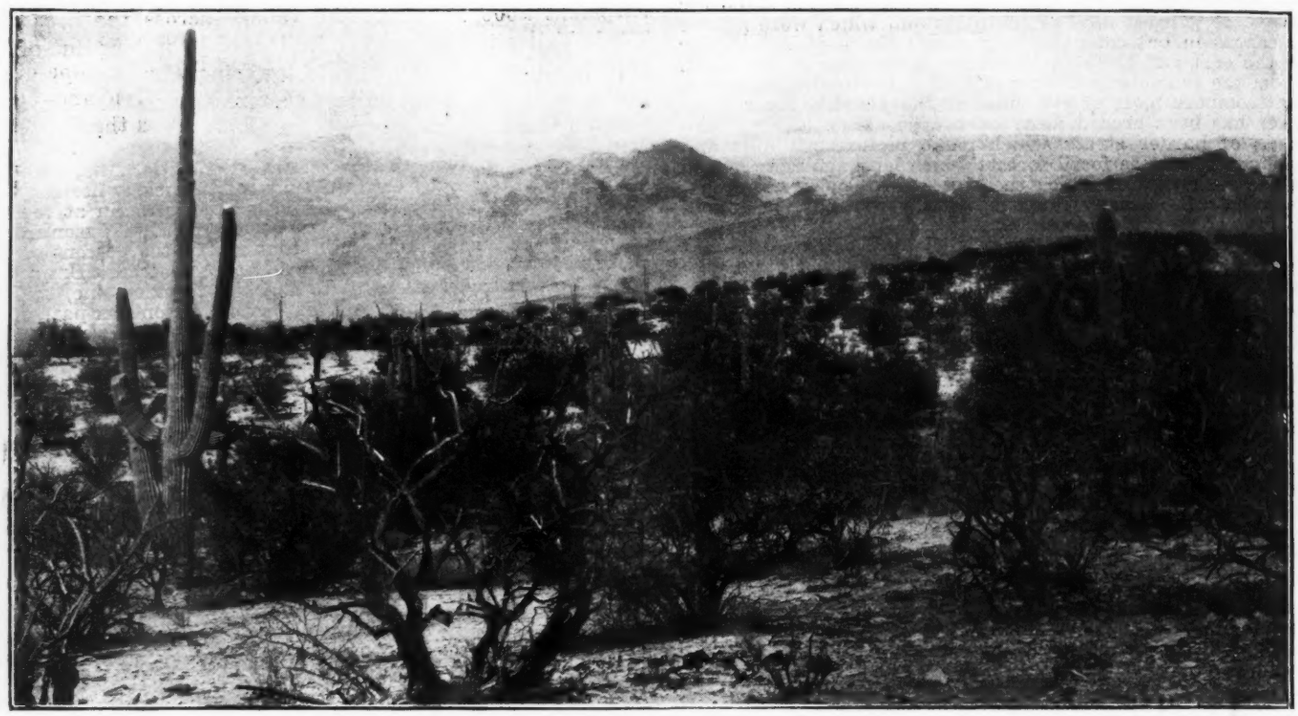
through cracks in the unstable blocks. These huge fragments are parts of the same massive plateau. The hummocks, of course, have been attacked by erosion, and the spaces between are filled with the débris which is still migrating slowly into the hollows.

The ore deposits, in all cases, are caused by gases or solutions escaping from the cooling igneous masses, carrying metals which they are able to dissolve while the heat and pressure are great enough, and depositing them when they lose some of their heat and pressure. This occurs when the gases escape into the inclosing rocks, or into such upper portions of the igneous masses themselves as may have already cooled. The relation between this action and the lines of structural weakness in the earth's crust is a simple and definite one, when broadly considered, and well worth noting. It is seldom that such a relationship is so clearly expressed in the surface topography as it is in the examples noted. Although this belt is described properly as the mountain region, its average elevation is considerably lower than that of the adjoining plateau, the loftiest peaks being little, if any, higher than the plateau summit. The average altitude is probably between 4000 and 5000 ft. The drainage is nearly all westward through the Gila and its tributaries, although a considerable area in southeastern Arizona and northern Sonora drains into the Yaqui River. All the drainage of the mining region goes finally to the Gulf of California.

Only on the higher summits will the Easterner see vegetation that looks familiar, with pines and junipers in abundance. The lower slopes and broad valleys take on varying aspects. Here, grassy plains and slopes littered with yellow gourds and interspersed with scattered live oaks; there, similar stretches clothed with a variety of thorny bushes, mesquites and greasewood; elsewhere, rocky knobs covered with ocatillas, palo verde and chollas—the most formidable and picturesque of the cactus family. Bare hills are made to look still more barren by weird forests of towering sahuaros—the giant cactus. Yuccas, in considerable variety, are found almost everywhere, with Joshua trees, Spanish bayonets, and soapweeds. Here and there one may see cottonwoods, black willows, hackberries, mountain ash, madrona, sycamore, black oak, manzanito, cherry, squawberry, ironwood, box elder, walnut, sage brush, and many others. The vegetation, of course, is not nearly so abundant, but seems quite as varied as in the well-watered countries of the east and north—so varied, so highly characteristic, and so well adapted to soil and climate that it adds materially to the scenic wealth of the United States.

"Adjoining the mountain region on the southwest," to quote Ransome again, "is the third topographic division, the desert region, which also contains many short ranges of mountains of prevalent northwesterly trend. In this region, however, most of the ranges are separated by broad desert plains, underlain by fluviatile and lacustrine deposits of late geologic age, or by undulating granitic lowlands partly covered with gravels and flows of lava. The boundary between the mountain and desert regions is, as previously stated, indefinite, but may provisionally be taken as a curved line extending from Nogales, on the Mexican frontier, past Tucson and Phœnix to Needles, at the California line."

Ransome might have added that this territory is lower, has been generally stripped by erosion of the Paleozoic sediments that may once have covered it, and is characterized by a vegetation more emphatically desert-like than that of the mountain region. The giant cactus, the creosote bush, the cholla, the barrel cactus, the palo verde and similar weird and strange plants are found everywhere. Familiar vegetation has almost vanished, and the average white man feels himself to be in a strange land.

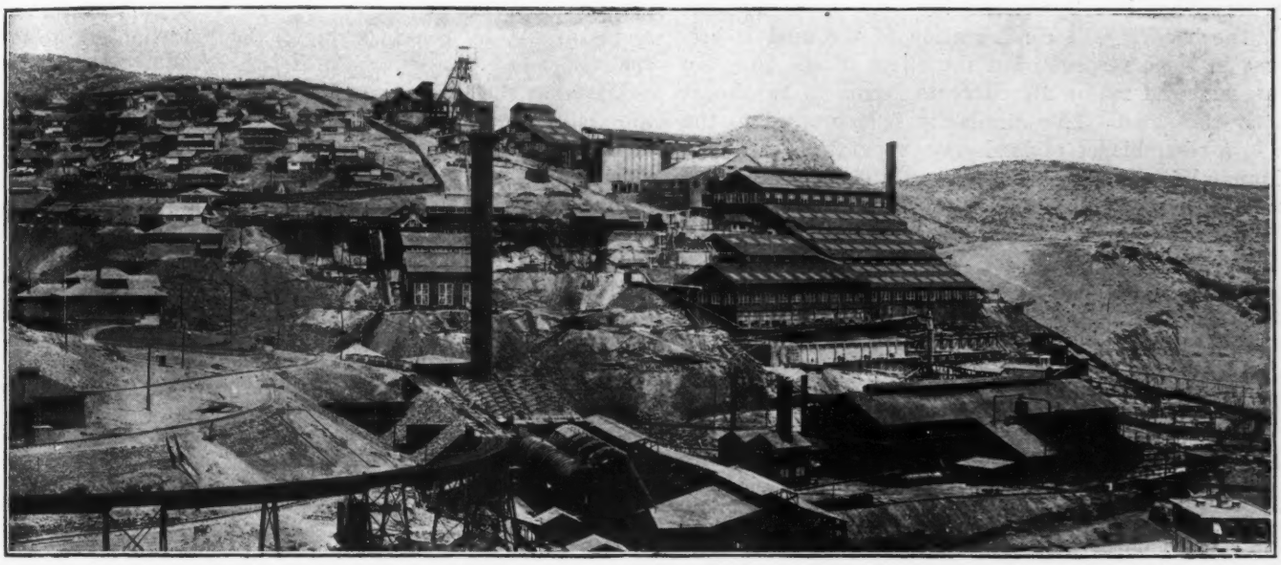


TALUS SLOPE FROM A GREAT FAULT BLOCK

The striking feature of desert topography—and this is true of the mountain region to almost the same extent—is the interminable talus slopes, made up of rock fragments that have cracked off the fault blocks or volcanic piles which form the projecting heights and been carried into the lowlands by the gushes of water from occasional cloudbursts. Geologists have given considerable study to this phenomenon. It is a mistake to suppose that sedimentary beds are necessarily deposited in water. Desert regions generally are areas of deposition, and the streams are too feeble to carry onward all the débris that is offered them. Sometimes there are no permanent streams at all; many desert regions are enclosed basins with no outlet to the sea.

In both mountain and desert belts in Arizona, faults of recent geologic age have often formed lakes by interrupting the flow of streams. These lakes have been filled up in all cases, I believe, and the streams have surmounted or cut through the obstruction and resumed their erosion. The Roosevelt dam is merely the artificial replacement of a natural dam which had been thus cut through; and the new lake fills merely a part of an old one. In some of the depressions, the talus accumulations are surprisingly deep, attributable, no doubt, to recent faulting. The Miami Copper Co. drilled a hole 2000 ft. deep into the so-called Gila conglomerate, merely a talus accumulation of Quaternary age, without reaching the bottom. This depression is thus much deeper than any present channel of erosion, and indicates a great change of level in the geological yesterday.

Here again is a fact, seemingly irrelevant to our main subject, but really important. These great accumulations of talus, or wash, occupy the larger part of the area both of the mountain and desert regions. The loosely compacted mass of angular and subangular fragments contains at every level abundant pore space, which enables it to fill an exceedingly valuable role in the conservation of the water supply. The occasional heavy rains pour floods from the mountains, which spread out over the talus slopes and playas. A large part sinks readily through the porous mass and reaches a level where its flow is impeded and often permanently stopped by barriers on the underlying rock surface. At the same time, this water is effectively protected from evaporation, and the lower portion of the accumulations is a succession of reservoirs of good water, which is utilized for mining, milling, and smelting plants as well as for towns, agriculture, and railroads. Thus the Gila conglomerate at Miami, already mentioned, furnishes water for the Miami and Inspiration mining companies. Part of the supply comes from the Old Dominion mine, the workings of which extend out under the conglomerate, and as a consequence are undesirably wet; but the heavy pumping consequently made necessary does not go entirely uncompensated, for the water is transferred to the Miami for use in that company's plants. The mines and town of Ajo are absolutely dependent on such a supply, as well as the large towns of Douglas and Tucson, with the various industries that support them. Many a valley is dotted with ranches which would not be there except for these talus reservoirs.



A MILL AND SMELTERY, SHOWING TOPOGRAPHICAL ADAPTABILITY OF ARIZONA, MORENCI, ARIZONA

In still another respect this feature promotes human occupation. If erosion were in control of the surface of such a region, its fault-block mountains would be rough surfaces of hard rock, trenched with tortuous ravines and deep canyons, destitute of soil, and, in the long droughts, ten times more parched and unwatered than they actually are. As a matter of fact, the depressions are pretty well filled up in long gentle slopes, which support vast areas of good soil, besides rendering the country infinitely more accessible than it otherwise would be. The railroads are not forced to follow crooked canyons cut in hard rock, but are able to dodge around the ends of the detached mountain uplifts and traverse the country in fairly straight courses and easy grades over the desert-made talus.

In many places the upper, and, possibly, the lower portions of the wash are hardened by a lime cement, the exact origin of which is not exactly clear to me. Perhaps it is lime derived from the weathering of the feldspars in the granitic or volcanic detritus and spread over the surface by the flow of water after the heavy but intermittent rains, the lime taken into solution being precipi-

tated by evaporation or by some other cause before it has traveled far, the flow of water not being abundant or persistent enough to carry it into a permanent stream and thus out of the country. However this may be, the process has evidently a considerable effect on the topography of the wash in those extensive areas which are now being eroded instead of being built up. Tracts hardened by caliche are more resistant and tend to stand out in the form of low ridges, domes, or mesas. The caliche supports a rather scanty soil except in places favorable for the accumulation of dust. Wherever this caliche is exposed and strewn over the surface—for instance, in grading for streets and houses—it presents the forlorn and desolate appearance of old mortar.

Population and Ethnology

I have already remarked that Arizona is geographically somewhat like Spain and Morocco, more particularly the latter. The configuration of the land is different in some respects, but the effect of the sun, the ocean, and the major air currents seems to be almost exactly the same. This similarity is expressed to the eye in a resemblance of landscape, vegetation and even in human life and arts. The northern strip of Africa is a frontier for dark-skinned races, which fill the tropical regions of the south. The white races of Europe have at intervals for thousands of years attempted to establish themselves on this border, but with no lasting success. The dark-skinned population has always swallowed up the white immigrants, or invaders. At times the races of Africa have been superior in arts and organization to the Europeans and have surged over and occupied the Mediterranean islands and the tips of the Spanish and Italian peninsulas, to be expelled again, leaving only minor after-effects on the population.

The copper fields of Arizona are in just such an ethnographic borderland. To the south is the dark-skinned Mexican race, upon which the Spaniards impressed their language and some of their arts, but not their color or their racial characteristics. To the north, in the colder plateaus, the white-American stock is rapidly swamping all racial competition and the Indian and Mexican population is already reduced to isolated fragments which have progressively less and less influence on their white neighbors. In the mountain and desert regions there is a racial deadlock. The organizing, industrial, and developing impulse comes from the white invaders, but there is no assurance that they will ever overwhelm the natives with their numbers.

The Mexicans resist absorption in a variety of ways. Though most of them speak or understand English, it is not their familiar tongue. Even in the schools, where all the teaching is in English, the Mexican children set themselves apart from the white children and immediately fall into Spanish. This language is invariably spoken in the household, even by those Mexicans who speak English so perfectly that one might imagine they knew no other tongue. This difference of language, added to difference of color, helps to perpetuate difference in habit and point of view; and all these things tend to restrain social intercourse between the two races. Industrially, the inhabitants of the region are not on the same level. The Mexicans do not produce anything like the same number of business leaders, professional men, engineers, or trained mechanics. They are, therefore, less highly organized, and their group efficiency is far lower; for it is group efficiency that promotes productivity.

American and Mexican Methods

The difference between the Mexicans and the whites in this respect is generally expressed in a difference of wages. When such a difference is imposed upon individuals who do the same work as white men there is an apparent injustice which leads to dissatisfaction. I would not like to try to arbitrate the difficulties which arise under such a state of affairs. A thousand Americans in a mine may produce twice as much from it as a thousand Mexicans, yet each American shoveler may not load any more cars than each Mexican shoveler. If the American shoveler is paid twice as much as the Mexican shoveler receives, the latter is not likely to see the justice of it. I can see no line of argument that seems likely to convince him; the question is too abstruse.

I am satisfied, however, that the laws of trade will inevitably impose a difference of wages. A mining organization of a thousand men, all Mexicans from the directors to the mule drivers, would almost certainly involve itself in mistakes of organization and engineering. I should expect that a white organization of the same number would avoid enough of those mistakes to enable it to produce twice as much ore with no greater effort. The result, in a competitive business, is bound to be the defeat and destruction of the Mexican organization. Only one thing can save it, and that is a willingness on the part of its members to accept low enough wages to allow the product to be sold at the price their competitor is willing to accept.

The actuality, so far as the mines are concerned, is a compromise. The Mexicans do not compete with the whites in finance, organization, management, or engineering; probably avoiding thereby the severe consequences of defeat. They do furnish a large part of the common labor; and the laborers, though not paid as much as white men, do undoubtedly reap some benefit from the organizing ability of the whites, because they get much higher wages than when they work under Mexican employers. In some places they are paid the same as white men.

It is easy to see, on the other hand, how the Anglo-Saxon imagination has been impressed by the sight of a Mediterranean civilization in an environment that is natural to it. Both the Spaniards and the Moors inherited much from the Romans, Phœnicians, and the predecessors of those peoples. Their architecture and their agriculture were developed to combat a blazing sun and long droughts. The word "rival" is a reminiscence of ancient quarrels over water rights. The fig, the olive, the orange, the date, and the grape are natural neighbors of the live oak, the yucca, the cactus, and the creosote bush. The massive walls of stone or mud, covered with stucco; the flat roofs, inner courts and gardens protected from wind and dust; the heavy porticos, or *portales*, refuges from the fierce sun—all are so natural under such an environment that they seem inevitable. Several different races have invented them independently. The architecture of the Pueblos and Aztecs bears a strong resemblance both in form and material to that of Morocco, Sicily, Syria, and Persia.

The Americans have brought with them an architecture inherited from the rainy climate of northern Europe and the eastern United States; steep roofs to shed the rain, many windows to make the most of the scanty light, spreading lawns and stately trees outside the house to serve as grateful reminders of aboriginal meadows and forests. They have brought, also, many appliances for heating, lighting, cooking and communication—products of their mechanical skill which are useful everywhere. But in many respects the north European forms do not fit in with the southwestern environment, and they are being rapidly modified under the guidance of experience, and with the growth of wealth, education, and good taste, to conform with standards which long human use has shown to be appropriate. In other words, the Yankees are learning much from the Mexicans.

Mining and Concentration of Carnotite

"Mining and Concentration of Carnotite Ores" is the title of Bulletin 103, recently issued by the Bureau of Mines, Department of the Interior, the authors being Karl L. Kithil and John A. Davis.

In a review of the investigations on radium by the Bureau of Mines, Van. H. Manning, director, stated that in 1912 the Bureau of Mines had its attention called to the value of the carnotite ore of Colorado and Utah as a source of radium and to the need of investigations and remedial suggestions to prevent waste of low-grade carnotite, to assure the miner a better price for his product, and to insure the profitable recovery of the highest possible proportion of the radium in the ore.

The carnotite deposits are situated on public lands and constitute the largest known supplies of radium ore in the world. Fortunately the Bureau was able to interest the late Dr. James Douglas, of New York City, and Dr. Howard A. Kelly, of Baltimore, Md., who wished to procure a supply of radium for use in the treatment of cancer. The suggestion was made that they form a radium institute. Accordingly, the National Radium Institute was incorporated for the purpose of studying the best methods of producing uranium, vanadium, and radium, and of the mining and concentration of ores from which these products may be obtained for use in radium therapy.

Subsequently, at the suggestion of the institute, a coöperative agreement was made under which the Bureau of Mines undertook to provide the services of skilled chemists and mineral technologists for the supervision of the mining and concentrating of the carnotite, and the National Radium Institute agreed to furnish the necessary funds for mining and concentrating a sufficient supply of ore and for recovering from it the radium, uranium, and vanadium. Under this agreement a radium-recovery plant was built in Denver, Colo., which began operations in June, 1914; and, when it stopped work in January, 1917, about 8½ grams of radium had been recovered. The cost, under the methods devised by the Bureau of Mines, was only about one-third the current price for radium. In addition, methods of saving the uranium and vanadium in the ores and of obtaining the metals in a pure state were perfected.

The agreement between the National Radium Institute and the Bureau of Mines expired in 1916. As a result of the work under this agreement, the Bureau of Mines has been able not only to demonstrate that radium can be produced at a cost much less than the selling price, but it also has been able to show how losses in mining and concentrating carnotite can be prevented, and resources conserved. Finally, for an expenditure of less than $38,000, the Bureau has received as its share of the results of the coöperative agreement more than $180,000 worth of radium.

The work of the Denver plant was discussed in Bureau of Mines Bulletin 104, "Extraction and Recovery of Radium, Uranium, and Vanadium from Carnotite." In the present bulletin K. L. Kithil, mineral technologist, and J. A. Davis, assistant mining engineer, describe the methods used in mining and concentrating the carnotite treated at Denver. As the workable carnotite deposits of Colorado and Utah, though lying near the surface, are relatively small, vary greatly in richness, and are extremely irregular in distribution, methods such as are ordinarily used for prospecting and mining shallow deposits must be modified. Also, it is necessary to examine the ore carefully, sort it closely, and frequently test its radium content with the electroscope. Finally, the carnotite deposits are mostly in an arid region, where water is scarce, so that dry rather than wet methods of concentration must be practiced. Hence the authors have given detailed information in regard to many operations that might receive little notice in an account of the mining of most metals, but the presentation of these facts in regard to carnotite is necessary because of their bearing on profitable mining and concentration, the utilization of low-grade ore, and the prevention of waste.

Treatment Charges for Molybdenite

According to the schedule of prices drawn up by the Canadian Department of Mines for the milling of molybdenite ores and concentrates, delivered f.o.b. testing plant, Ottawa, concentrates will be made on the following terms:

1. On assay returns from samples dried at 212°.
2. Moisture will be deducted.
3. The treatment charge to be $5.65 per ton of 2000 lb. of crude ore.
4. Credit will be given for molybdenite only. No allowance made for molybdite or wulfenite.
5. Recoveries of molybdenite per ton of 2000 lb. dry ore delivered railway siding, mines branch testing laboratories, Ottawa:

For molybdenite ores containing—

A. Between 0.5% and 1% inclusive for 70% of the total molybdenite content.

B. Between 1.1% and 1.5% inclusive for 78% of the total molybdenite content.

C. Between 1.51% and 2.0% inclusive for 84% of the total molybdenite content.

D. Between 2.1% and 2.4% inclusive for 87% of the total molybdenite content.

E. Between 2.51% and 3.0% inclusive for 90% of the total molybdenite content.

F. Above 3% for 92% of the total molybdenite content.

The Moore-Edmands Process of precipitating gold from cyanide solutions by means of pulverized charcoal is being adopted at the Riverina South gold mine, Western Australia, and is also being tried out in South Africa.

War Efforts at the Trail Smeltery And Refinery

One of the informative features of the discussion which took place at the Annual Northwest Mining Convention held at Revelstoke, B. C., from July 9 to 12, was S. G. Blaylock's address on "The Part Played in the War by the Trail Smeltery." Having held the position of assistant general manager of the Consolidated Mining and Smelting Co., and owing to his high standing in British Columbia mining circles, his observations were listened to with profound attention.

Mr. Blaylock said that no better illustration of the work done for the British Empire by the company could be given than a rough account of the zinc industry. One of the problems to be solved was how to separate the zinc from the lead in ores; and, although this matter had received close attention, and endless experiments had been made, when the war broke out the company was making only half a ton of zinc a day. The Germans had a strangle hold on high-grade zinc, and, in fact, on all other grades.

To quote Mr. Blaylock:

"The Imperial Munitions Board was in dire need of high-grade zinc, which was selling at from 35 to 45c. per lb., when obtainable at all. The supply appeared to be cornered by the Germans, and it was on this account that the company agreed to build a plant, based on experimental work, to make 20 tons of zinc a day, at a price of 15c. per lb.—less than one-half of the current price. This was rapidly followed by demands for a larger and a still larger production, but at the same price. Before the plant could be designed and orders placed, preliminary quotations on many things were doubled.

"The plant required proved to be more extensive than was originally estimated. The price of sulphuric acid was prohibitive, necessitating the installation of a sulphuric-acid plant. Many other difficulties arose and were overcome, and finally the plant was completed and in operation. Hundreds of difficulties which did not develop in the small experimental unit were encountered when the big plant was started. These were met and surmounted by the incessant work of those in charge. It would be extremely difficult to give the right credit to the proper persons.

"Some of the main points of the process as carried out are the counter-current leaching, the neutral solution by addition of an excess of ore (in other words, a double leach); the thorough purification of solution; the development of suitable pumps and air lifts for handling solids and solutions; the proper content of the electrolytic tanks to prevent the breaking up of the electrolysis and the formation of hydrogen; the keeping down of the volatile, and the development of efficient melting furnaces. Much work has been done on the residues, and we feel that we soon will be in a position to treat these successfully, the trouble to date being to get the zinc in these tails sufficiently low to allow of their profitable treatment for lead and silver.

"The government aided in financing the company to the extent of lending about 30% of the money necessary to build the plant. This money, however, was merely a loan, and has to be repaid in full. A bounty was also promised and has been extended, which would insure a price 2c. per lb. better than the price of Prime Western spelter, unless the price of this grade was 9c. per pound."

It will be seen that the starting of this electrolytic plant at Trail, B. C., together with the one established almost simultaneously at Anaconda, Mont., had a strong bearing, and probably was the determining factor in finally releasing the long-maintained German hold on high-grade zinc.

Mr. Blaylock, continuing, said that, in order to insure the greatest possible output of lead for the Imperial Munitions Board, the company took all the customs ore offered until the board notified it that no more could be handled. To accommodate this customs ore (which had increased from less than 30 tons a day when the metal markets were low at the start of the war, to over 200 tons a day when metal prices were high, immediately prior to the cancellation of the contract by the Munitions Board) it was necessary to curtail shipments from the company's own properties to a minimum, thus losing the advantage of the high price of lead, but contributing greatly to the ultimate winning of the war.

In enumerating some of the calls made on the company during the crisis Mr. Blaylock said:

"The Consolidated was also requested to build a refinery for the production of copper; and, though comparatively small, the erection and operation of this refinery, together with the necessary converter plant, was a large undertaking for a company which had lost so many of its best employees, who had answered the country's call for men to go overseas."

Cost Comparison of Canadian And United States Copper Refining

In connection with a recent report containing an estimate of cost for the construction of an electrolytic copper refinery in Canada, J. E. McAllister stated, before the Canadian Munition Resources Commission, that whereas the cost of refining copper at this hypothetical plant had worked out to $13 a ton, the New Jersey plants were doing the same work for $8 a ton. This discrepancy was due almost entirely to the fact that the cost figures of the Canadian plant were based on a capacity of only 50,000 tons of copper annually, whereas the cost figures for the American plants were the result of operations on a scale of 100,000 to 150,000 tons annually. Mr. McAllister was of the opinion, however, that a Canadian plant of the same capacity as the American plants would not be able to refine for the same cost, $8 a ton, because there were other factors which assisted the American plants and which could not be expected in connection with a Canadian refinery for some time. These included a highly organized and trained staff, cheap and rapid transportation of all raw materials and supplies, and a better labor market. It was true that the American plants were not securing their electric power for as low a figure as the Canadian refinery could expect from the Niagara power companies, but this advantage would be more than offset by the items mentioned above; and McAllister did not consider that a Canadian plant under the most favorable circumstances and with a capacity of 150,000 tons a year could refine copper for much less than $10 a ton.

Filter Adjustments at Packard Mill At Rochester, Nevada

BY F. DEAN BRADLEY*

Difficulties that arose in operating a continuous filter at the Nevada Packard mill at Rochester, Nev., were solved in simple ways. A mechanical sampler and a mixer for repulping the tails were added to the filter, the number of washes was increased and a home-made nozzle was made at small expense for spraying the wash solutions.

THIS article is not intended as a criticism of the filter mentioned. Certain difficulties arose in connection with the efficient handling of tailings at the mill of the Nevada Packard Mines Co., at Rochester, Nev., while I was in charge of the plant, and they were largely overcome by the changes here described. Since the filtration of slimes has become one of the important factors in the successful operation of most metallurgical plants, it is believed the experiences related may be of benefit in other cases.

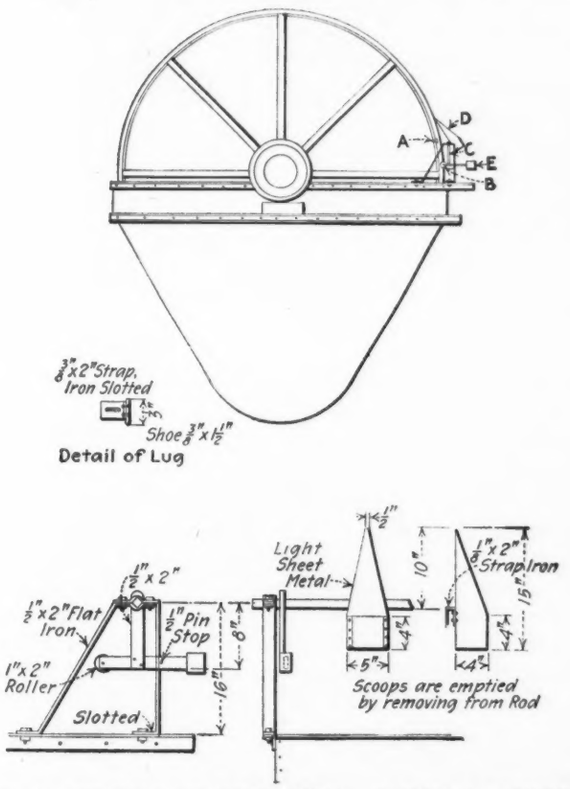


FIG. 1. DETAILS OF MECHANICAL TAILINGS SAMPLER ATTACHED TO OLIVER FILTER

The Packard mill has been thoroughly described in previous issues of the technical press, and it will not be necessary here to give details on other than the filtration end. Briefly, the material treated is an oxidized silver ore, finely ground in ball and tube mills, direct-treated with cyanide, agitated and settled by Dorr machinery and led from the last thickener to an Oliver continuous filter. The tailings from there are discharged to a belt conveyor and thence to the dump.

At the time our tests began, we were experiencing one of the coldest winters in years. Any excess wash on the filter meant a high moisture content in the tails, resulting in a wet, slimy product that would freeze on the conveyor belt, ball up the rollers with ice and completely block the conveying machinery. It was therefore essential that no water be wasted or allowed to run down on the conveyor side. At the same time, the dissolved loss was running high, and yet we could not add excess wash on the reverse side of the filter because of building up the solutions too rapidly.

Hand Sampling of Tails Gave Erratic Results

During this time the tailings samples were taken by hand, supposedly at regular intervals; and, though all carried more silver than they should have, the assay results were erratic, and showed the extraction to be varying from fairly good to a very low percentage.

Another troubling feature was the blocking of the conveyor when the attendant was engaged at other work. When this happened, there was nothing to be done but to shut off the feed and allow the pulp to bank up in the thickeners. After several occurrences of this kind, the difficulty of properly washing and settling becomes apparent.

One trouble with the filter itself was the leaking of the packing glands around the agitator shaft. The pulp thus lost was valuable for its dissolved content; furthermore, it froze as it struck the floor and made a huge ice pond around the base of the filter, which had to be chopped out whenever access to the drains was necessary. This was at first thought to be the result of eccentricity in the agitator shaft, which had been sprung previously; but after a new shaft was installed and the bearings had been realigned and packed, so that the shaft ran perfectly true, the packing continued to be cut out and so cause leakage.

One of the operators suggested that he had seen rubber gaskets used in the oil fields where packing in pumps would not hold. It was decided to try this, and accordingly several gaskets were made to fit the stuffing boxes, the material being obtained from old diaphragms taken from the diaphragm pumps. The trouble was overcome at once. Later a rubber packing manufactured by one of the rubber products companies was secured, and it worked satisfactorily. Incidentally, while mentioning the change in the agitator shaft, it may not be amiss to state that no provision is made for the removal of this part without taking out the filter drum itself—a big undertaking, and an almost impossible task in a confined space. We found it necessary to cut a manhole at one end of the tank to get it in place. It is suggested that this could be easily done by the manufacturers and greatly improve the machine at small cost.

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Though most of the changes were carried on at the same time, the first duty was to ascertain where we stood in the matter of extraction. From experience I knew it was impossible for the two men who operated the entire mill to be on hand at the regular periods set for sampling, and in numerous cases I had seen enough samples taken to make up for the lost intervals. Some method of automatic sampling was necessary, and the simple mechanical device presented in Fig. 1 was the result of a few days' study.

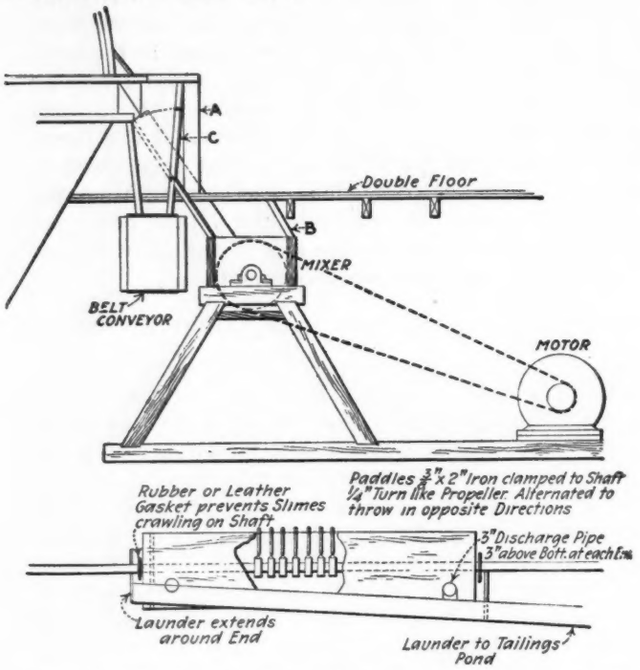

A
C
Double Floor
B
MIXER
BELT CONVEYOR
MOTOR
Rubber or Leather Gasket prevents Slimes crawling on Shaft
Paddles ¾" x 2" Iron clamped to Shaft ¼" Turn like Propeller Alternated to throw in opposite Directions
3" Discharge Pipe 3" above Bott. at each End
Launder extends around End
Launder to Tailings Pond

FIG. 2. MIXER USED FOR REPULPING FILTERED CAKE FROM OLIVER FILTER

In this, the trip lug, *A*, attached to the filter drum, engages the roller, *B*, pushes back the suspended lever, *C*, which operates the square shaft supporting the scoop, *D*, thus turning the point of the scoop into the drum and the filtered cake. When the lug passes, releasing the lever, the weight, *E*, returns the mechanism to the original position. The size of the sample can be regulated by lengthening or shortening the face of the lug so as to increase or decrease the contact, or more scoops may be used. The filter running at seven revolutions per hour just filled the sample pockets once a shift, when using a 2-in. lug face and discharging a ½-in. cake.

To overcome the troubles from the conveyor and to use more wash water on the filter, we took up the idea of a mixer to repulp the filtered cake. This would enable us to wet the tailings as much as necessary and to discharge them as a flowing pulp rather than a heavy cake, which gave us considerable trouble from freezing as it was discharged, piling up at the end of the belt even when a steady stream of water was played on the pile. A mechanism shown in Fig. 2, consisting of a long rectangular box, a screw conveyor and a shaft extending through packing glands to a pulley belted to the conveyor drive, was bought and installed at the end of the conveyor at first to overcome this tendency to pile up. This worked well for a couple of days until the packing glands wore out, after which it made matters worse than before. It had been the experience of the several men engaged in this work, that glands and stuffing boxes in machines handling gritty material, whether they be pumps, agitators or mixers, soon cut out under the action of the pulp.

Working with this prejudice, we undertook to devise a mixer that would eliminate the glands and packing and to install it so that it could be used as an auxiliary when the conveyor was not in commission. As may readily be seen from Fig. 2, all material used in its construction was obtainable at the mine or mill except the shaft, which latter could probably be found in the scrap pile of any old property. The box was 2 x 8 ft. in the clear and contained 20 paddles. The shaft was $2\frac{7}{16}$ in. in diameter and was set with three outboard bearings and passed through holes in the ends of the box which gave ample clearance. The advantage of this arrangement over that having packing glands and bearings on the mixing box is obvious. The paddles were run at 220 r.p.m. and the power consumed was between one and two horsepower.

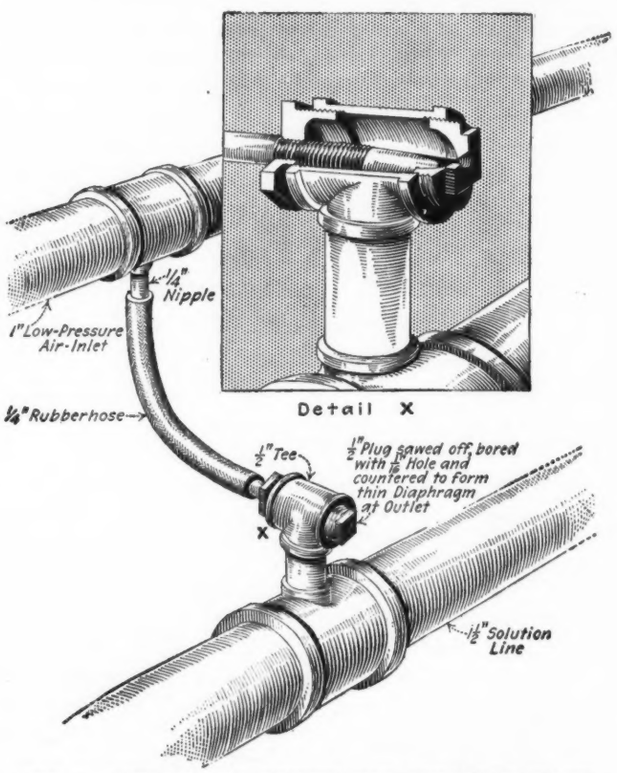


FIG. 3. HOME-MADE DEVICE FOR SPRAYING WASH SOLUTIONS EMPLOYED IN OLIVER FILTER

With these mechanical difficulties overcome, we next turned our attention to the dissolved loss in the tailings. Notwithstanding extreme care with our thickeners, considerable value in solution went to the filter in a pulp thicker than 1 to 1. We could not add more wash water than we were using, on account of excess solutions. It had been found that the warm water from the jackets of the mine compressor helped largely, and that it was about the amount required to make up the natural loss in solutions. To get around the excess solutions and still give the cake an added wash, we brought the barren solution directly from the filter presses. The effect of this was immediate. When the filter presses

were carefully watched, so that there was no value in the barren solution, the dissolved losses dropped to a minimum.

We were still dissatisfied with the manner of distributing the washes. We were using perforated pipes over the filter, the barren solution on the reverse side followed by the hot water on the discharge side. Neither had enough head to spray through a nozzle under its own pressure; consequently the solutions collected in streams and cut channels as they ran down over the filter, leaving the high points more or less dry. Acting on the suggestion of the general superintendent, we then tried an Ingersoll-Rand spray, of the type used in connection with their machine drills, to spread these solutions with compressed air. It worked perfectly, but when we found the cost of these to be excessive for the number we required, we fell back on our own resources once more.

We took some ¼-in pipe, drew several nipples to a point, bored pinholes in the ends, threaded them full length, then inserted them in a ½-in. bushing. The latter was screwed into a ½-in. tee. We plugged the other end of the tee, sawed off the square shoulder of the plug and bored the remaining part, assembled the whole as shown in Fig. 3, and had a nozzle which in labor and material cost less than $1.50. The spray was regulated by screwing the pointed nipple in or out. This opened or closed the water outlet so that the spray could be made a heavy stream or a fine mist.

During all these innovations, the employees as well as the superintendent's office were consulted freely, their suggestions and ideas were considered and credit was given where due. As a result, when I left to accept another position, the men had become so interested that they were still figuring improvements not only on the filter but in other units of the mill.

Greater Discussion of Mill Defects Desirable

In conclusion, permit the suggestion that we read much of the perfections of the various new plants and nothing of their defects or shortcomings. Sometimes, the contributors of descriptive articles on this subject are the representatives of the constructing engineers or regular magazine correspondents, who are shown the merits of the mill rather than the points to be improved; consequently, those details for which the operator looks and finds wanting are overlooked.

The Packard mill is one of the most modern and perfect reduction works of its kind that has been built. The record of its work for the first few months is a tribute to its designer, and it is manifestly not to detract from the credit due him that this is written, but nearly every machine, idea or mill is revised and improved before it is perfected. It is these revisions and improvements that count in the long run, and not enough is heard of them. I hope that the few details set down here will induce more worthly contributions along the same line.

Mineral Wool is now being manufactured at Yarraville, near Melbourne, Australia. It is fabricated from basalt rock or bluestone, and a pure white product of metallic lustre is obtained with a staple of from 1½ to 2 in. The mineral wool is soft and pliable and can be used for many purposes for which the cheaper varieties of asbestos were considered almost indispensable, such as insulation for ice chests, engine cylinders, steam pipes, and like purposes.

Control of Mining by the State

The final reports of the South African State Mining Commission, together with the minutes of the evidence taken, have been published in a "blue book." The reports deal with information obtained from Britain, Australia, Belgium, Canada, Egypt and Germany, and the conclusions, according to the *Iron and Coal Trade Review*, are: (a) That the industrial operations of the state are adversely affected by considerations of a political nature. (b) That the state cannot and does not organize on such efficient lines as private enterprise. (c) That a system of Parliament and Ministerial control is not adapted to a highly specialized industry or business. (d) That in actual practice the state finds it impossible and impracticable to mine as cheaply and as efficiently as private enterprise. (e) That state coal mining has not resulted in a reduction of prices to the consumer. Unless the state works at least as economically as the private producer, it is conceivable that state coal mining might send up the price of coal, to the detriment of industry and the general community. (f) That the state is not so good an employer as the well-directed private concern. (g) That the workmen are in a more favorable position to bargain and obtain better conditions of wages and work from the private employer than from a government. (h) That the private employer pays higher wages than the state, and, generally speaking, raises the standard of efficiency, and therefore the earning capacity of employees; but government employment tends to produce the "government stroke" and a uniformity of output and capacity which militates against the highest standard of national development and efficiency.

Jackhamers *vs.* Reciprocating Machines

In the annual report of the Robinson Deep mine, Transvaal, South Africa, the manager, J. J. Wessels, stated that during the year an improved method of stoping was evolved by the adoption of the jackhamer machine. Its use has resulted in a saving of native labor, and it is more economical in explosives than the reciprocating machine. The results for the six months ended Dec. 31, 1917, when an average of 28.5 jackhamers were in continuous use for stoping, show that the average fathomage per jackhamer was 12.4% higher than that of the reciprocating machine, the latter using approximately 100% more labor per machine shift and 86% more explosives per fathom broken. The reciprocating machine used 102% and the jackhamer only 9% more explosives per fathom than was employed in breaking rock by hand labor. During the period each jackhamer, employing an average of 1.25 natives, did the equivalent fathomage of seven hammer boys, so that the replacement by jackhamers of the 37,000 to 62,000 hammer boys employed at the Witwatersrand mines at various periods would save for other work a large percentage of the present native labor force. Dust tests showed that stopes operated by the jackhamer (which cannot be worked without water) and stopes operated by hand labor were about equal, though the stopes where the reciprocating machines were used were about 100% higher in mineral dust.

Senate Passes Bill To Authorize Mining On Indian Reservations

The bill authorizing mining for metalliferous minerals on Indian reservations recently passed the Senate and has been favorably reported on by the House committee. The provisions in the measure are as follows:

SEC. 1. That the Secretary of the Interior be, and hereby is, authorized and empowered, under general regulations to be fixed by him and under such terms and conditions as he may prescribe, not inconsistent with the terms of this act, to lease to citizens of the United States or to any association of such persons or to any corporation organized under the laws of the United States or of any state or territory thereof, any part of the unallotted lands within any Indian reservation heretofore withdrawn from entry under the mining laws for the purpose of mining for deposits of gold, silver, copper, and other valuable metalliferous minerals, which leases shall be irrevocable, except as herein provided, but which may be declared null and void upon breach of any of their terms.

SEC. 2. That after the passage and approval of this act unallotted lands within Indian reservations heretofore withheld from disposition under the mining laws may be declared by the Secretary of the Interior to be subject to exploration for and discovery of deposits of gold, silver, copper, and other valuable metalliferous minerals by citizens of the United States, and after such declaration mining claims may be located by such citizens in the same manner as mining claims are located under the mining laws of the United States: Provided, That the locators of all such mining claims, or their heirs, successors, or assigns, shall have a preference right to apply to the Secretary of the Interior for a lease, under the terms and conditions of this act, within one year after the date of the location of any mining claim, and any such locator who shall fail to apply for a lease within one year from the date of location shall forfeit all rights to such mining claim: Provided further, That duplicate copies of the location notice shall be filed within sixty days with the superintendent in charge of the reservation on which the mining claim is located, and that application for a lease under this act may be filed with such superintendent for transmission through official channels to the Secretary of the Interior.

SEC. 3. That leases under this act shall be for a period of 50 years, with the preferential right in the lessee to renew the same for successive periods of 10 years upon such reasonable terms and conditions as may be prescribed by the Secretary of the Interior, unless otherwise provided by law at the time of the expiration of such periods: Provided, That the lessee may, in the discretion of the Secretary of the Interior, be permitted at any time to make written relinquishment of all rights under such a lease and upon acceptance thereof be thereby relieved of all future obligations under said lease.

SEC. 4. That in addition to areas of mineral land to be included in leases under this act, the Secretary of the Interior, in his discretion, may grant to the lessee the right to use, during the life of the lease, a tract of unoccupied land, not exceeding 80 acres in area, for camp sites, milling, smelting, and refining works, and for other purposes connected with and necessary to the proper development and use of the deposits covered by the lease.

SEC. 5. That the Secretary of the Interior, in his discretion, in making any lease under this act, may reserve to the United States the right to lease, or otherwise dispose of the surface of the lands embraced within such lease under existing law or laws hereafter enacted, in so far as said surface is not necessary for use of the lessee in extracting and removing the deposits therein: Provided, That the said Secretary, during the life of the lease, is hereby authorized to issue such permits for easements herein provided to be reserved.

SEC. 6. That any successor in interest or assignee of any lease granted under this act, whether by voluntary transfer, judicial sale, foreclosure sale, or otherwise, shall be subject to all the conditions of the approval under which such rights are held and also subject to all the provisions and conditions of this act to the same extent as though such successor or assign were the original lessee hereunder.

SEC. 7. That any lease granted under this act may be forfeited and canceled by appropriate proceedings in the United States district court for the district in which said property or some part thereof is situated whenever the lessee, after reasonable notice in writing, as prescribed in the lease, shall fail to comply with the terms of this act or with such conditions not inconsistent herewith as may be specifically recited in the lease.

SEC. 8. That for the privilege of mining or extracting the mineral deposits in the ground covered by the lease the lessee shall pay to the United States, for the benefit of the Indians, a royalty which shall be five per centum of the gross value of the output of the minerals at the mine, due and payable at the end of each month succeeding that of the extraction of the minerals from the mine, and an annual rental, payable at the date of such lease and annually thereafter on the area covered by such lease, at the rate of 25c. per acre for the first calendar year thereafter; 50c. per acre for the second, third, fourth and fifth years, respectively; and $1 per acre for each and every year thereafter during the continuance of the lease, except that such rental for any year shall be credited against the royalties as they accrue for that year.

SEC. 9. That in addition to the payment of the royalties and rentals as herein provided the lessee shall expend annually not less than $100 in development work for each mining claim located or leased in the same manner as an annual expenditure for labor or improvements is required to be made under the mining laws of the United States.

SEC. 10. That the Secretary of the Interior is hereby authorized to examine the books and accounts of lessees, and to require them to submit statements, representations, or reports, including information as to cost of mining, all of which statements, representations, or reports so required shall be upon oath, unless otherwise specified, and in such form and upon such blanks as the Secretary of the Interior may require; and any person making any false statement, representation, or report under oath shall be subject to punishment as for perjury.

SEC. 11. That all moneys received from royalties and rentals under the provisions of this act shall be deposited in the Treasury of the United States to the credit of the Indians belonging and having tribal rights on the reservation where the leased land is located, which moneys shall be at all times subject to appropriation by Congress for their education, support, and civilization.

SEC. 12. That the Secretary of the Interior is hereby authorized to perform any and all acts and to make such rules and regulations not inconsistent with this act as may be necessary and proper for the protection of the interests of the Indians and for the purpose of carrying the provisions of this act into full force and effect: Provided, That nothing in this act shall be construed or held to affect the right of the state or other local authority to exercise any rights which they may have to levy and collect taxes upon improvements, output of mines, or other rights, property, or assets of any lessee.

SEC. 13. That the provisions of this act shall not apply to the Five Civilized Tribes and Osage Nation of Indians in Oklahoma.

Honduras Intends to Reduce the Fineness of Its Peso, or dollar, to 500 parts per 1000, and explains that the change is necessary on account of the withdrawal of so many of the coins from circulation. This has resulted from the fact that the bullion value of the normal coin is well in excess of its face value, and has led to extensive though illegal exportation and sale by private individuals. The government now plans to mint half a million new pesos out of a quarter of a million existing coins. The new pesos will be of the same size as their predecessors, but base metal, probably copper, will constitute the moiety of their contents.

Blast-Furnace Smelting of Stibnite

Details of experimentation in the blast-furnace smelting of stibnite, showing the effects of varying flux charge, and discussing, also, the minimum economic limit of coke required. The theory of antimonial ore smelting and the various other processes of recovery, and their individual application and result, are considered.

AT A MEETING of the Institution of Mining and Metallurgy held on Mar. 7, 1918, an interesting paper, by W. R. Schoeller, was presented. Dr. Schoeller's problem was the proper treatment, in a circular blast furnace 36 in. in diameter at the tuyeres and with a column of charge not exceeding 10 ft. above the tuyere level, of sulphide ore containing 49 to 57% antimony, of which 2% at most was present as oxide, and 19 to 26% of insoluble, chiefly quartz. As fluxes he had pure chalk (better than 50% excess CaO), tap cinder, burnt pyrites, basic slag from a lead blast furnace, and niter cake. Hering[1] had smelted liquation residues with tap cinder, limestone, and 14% of coke in a 40-in. furnace with about a 20-ft. column, obtaining a grayish metal running about 40% antimony, 50% iron, and 10% sulphur, with a smelting loss of about 10%. Dr. Schoeller tried a similar charge with 15% coke, adding metallic iron for better reduction, and obtained a slag running about 1% antimony, 33% silica, 40% ferrous oxide and 16% lime; a metal running 75% antimony and 20% iron; together with varying quantities of an antimony-iron-sulphur matte. His losses were about 7% in slag and matte and 33% by volatilization.

Cause of Deficiency of Iron in Slags

At various times during the first operations the supply of metallic iron ran out, and it was noticed, contrary to expectations, that this did not raise the antimony content of the slag; so the iron was omitted altogether. This resulted in the formation of a sticky slag, which, upon analysis, was found extremely deficient in iron, showing that the coke had reduced the ferrous oxide from the iron flux to metallic iron, which then combined with the antimony to yield ferruginous metal of the same composition as before, leaving the slag too siliceous. The coke was therefore cut down by successive stages to 7½% in an attempt to avoid this overreduction, and this proved highly successful, the slag being satisfactory and the metal being almost entirely free from iron. Further, no matte whatever was produced. The furnace top also became much cooler, reducing the volatilization losses. An attempt still further to diminish these losses by reducing the coke to 7% resulted in freezing up the furnace, so it was clearly established that 8% was the lowest practicable amount of coke possible, that no additional reducing agent was required, and that the only fluxes necessary were those required to slag off the gangue material of the stibnite ore.

Regarding furnace manipulation, the greatest trouble experienced was that the contents of the crucible gradually froze from the bottom upward, so that, although at blowing in the furnace had a deep crucible with two tap holes, it was never long before the whole crucible was filled with solidified material, the metal then running out with the slag. It was therefore necessary to adopt continuous discharging and outside settling in a separator. A further improvement which was recommended would be a shallow reverberatory fore-hearth with a coal fire, which would give a perfect separation of slag and metal. It was also found necessary for smooth running to keep the antimony contents of the charge under 20%. Low blast pressure and a smelting column of at least 15 ft. were further recommended.

[1]Dingler's Polytechn. Journ., 1878, 230, 253.

Theory of Blast-Furnace Smelting

As to the theory of the blast-furnace process, Dr. Schoeller's earlier researches[2], together with the operation described, have convinced him that the ore blast, and not the coke, is responsible for the production of the antimony; that the molten stibnite absorbs oxygen from the blast, giving a trioxide which is soluble in the sulphide; and that the oxide at once reacts with a further quantity of sulphide with formation of metal and sulphur dioxide, thus:

$$(1)\ 2Sb_2S_3 + 9O_2 = 2Sb_2O_3 + 6SO_2.$$
$$(2)\ 2Sb_2O_3 + Sb_2S_3 = 6Sb + 3SO_2.$$

The rest of the paper is devoted to consideration of the various processes for extracting antimony, and the advantages and defects of each process and its applicability to the class of ore for which it is best suited. No matter what the process used, a perfect flue system and efficient condensing plant are requisites of prime importance for any antimony smeltery. There are four processes in common use:

1. Roasting to the trioxide, with subsequent reduction by carbonaceous fuel.
2. Blast-furnace smelting.
3. Liquation.
4. Precipitation by iron.

Applicability of Methods

The first method is suitable for lean ores and liquation residues, but its application to the former is necessarily local, as the works have to be operated close to the mines to avoid payment of heavy freight on low-grade material. It is generally referred to as the "French process." Blast-furnace smelting is best adapted to ores containing 25 to 40% of metal, and its one disadvantage—high volatilization—can be decreased by using a tall shaft. For ores from 45 to 60%, liquation is the best process. It produces a large proportion of crude antimony metal direct. The richest ores (over 60%) are best treated by the precipitation process, which also produces pure antimony from the crude product made by liquation. The reverberator furnace is used, the addition of the iron being effected in one of several ways. This metal exerts under proper conditions its preferential affinity for sulphur over anti-

[2]"On the Reduction of the Oxides of Antimony and Bismuth by their Sulphides." Journ. Soc. Chem. Ind., 1915, XXXIV, 6. "Notes on Chinese Antimony Ores, Crude and Regulus." Journ. Soc. Chem. Ind., 1913, XXXII, 260. "Oxygen and Metallic Antimony in Crude Antimony." Journ. Soc. Chem. Ind., 1914, XXXIII, 169.

mony, and yields high-grade antimony metal. The refining and "starring" of antimony are done on a large scale in reverberatories; in small works those processes are accomplished in graphite crucibles.

Views on Foregoing Data

In the discussion which followed S. J. Speak stated that he thought Dr. Schoeller's paper of particular interest because of his own experience in the smelting of highly zinkiferous oxidized lead ores under conditions necessitating the production of similarly basic iron slags. He noted many parallelisms between the two processes, but said that he had found 10% to be the minimum coke possible, due, no doubt, to the carbon required to reduce his iron-ore flux to the ferrous state and also to reduce his lead carbonate. He believed that the real cause of Dr. Schoeller's greatest furnace troubles was the formation during blowing in of a crust of unburnt charcoal and semi-fused slag just above the crucible. He advocated the breaking up of this crust by barring, or neutralizing its effect by providing for a continuous flow of both slag and metal at different levels in the furnace.

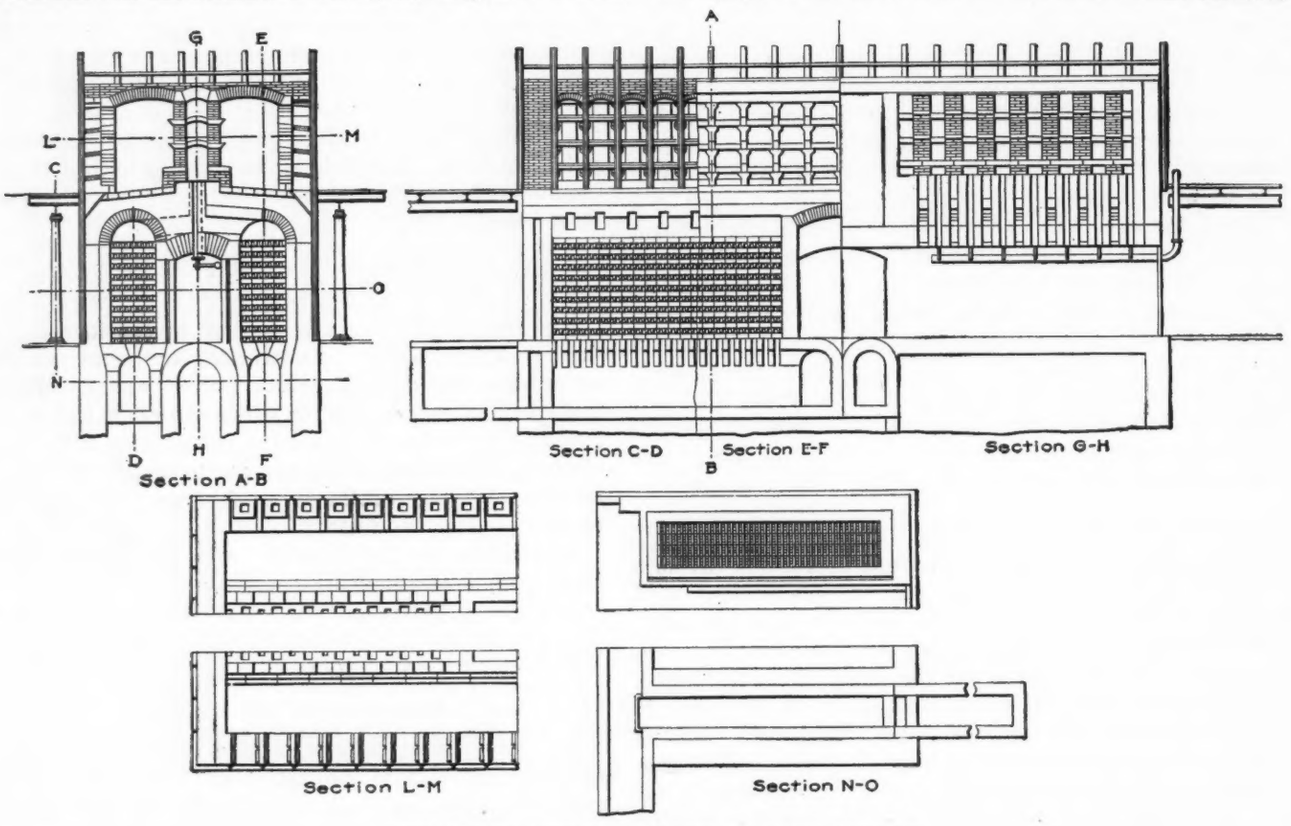
The Zinc-Smelting Works Of Vado Ligure

By Erminio Ferraris*

The Societa di Monteponi has built in Vado Ligure, near Savona, Italy, a zinc-smelting works, which was started last September. This plant is planned for 12 distilling furnaces, each of 216 retorts, but only three have been built as yet, since we are waiting for the results of the first furnaces, which are each of different design, though of the same capacity.

The plant is adjacent to a large coke factory, which supplies its superfluous gas to the smelting works after being spoiled of all byproducts. This gas is of nearly 4500 calories. It is first stored in a large gas holder, which delivers it to the furnaces at a pressure of 12 cm. of water. Near the furnaces is the pottery for making the retorts. The retorts are made of refractory clay of the Marne (France) mixed with graphite from Pinerolo.

The accompanying drawing of one of the furnaces shows that it is fitted with recuperators after the Siemens system. They deliver the air at nearly 700° C. to a middle combustion chamber, where the gas is introduced from below by means of pipes. Every 30 minutes air and gas are reversed as usual. The retorts are of 1.56 m. length, of oval section, 0.20 m. x 0.30 m.; they are disposed in three rows at each side of the furnace.



ZINC-DISTILLATION FURNACE AT VADO LIGURE

The furnace charge is crushed to 3 mm. size and is thoroughly mixed with coke breeze. The average ore charge of a retort is 35 kg. The distillation is performed in 24 hours. The gas consumption is 8000 cu.m. a day in smelting soft ores, and less than 10,000 cu.m. in treating refractory ores. Nearly 1¼ cu.m. gas are required for the distillation of one ton of ore. The retorts residues are rich in lead. After being concentrated they go to the lead smelting works of Monteponi company in Sardinia.

[I believe this is the first zinc smeltery ever operated with the use of waste gas from coke manufacture for the heating of the furnaces. The idea has been not infrequently suggested in cases where byproduct coke ovens are to be installed and there is no market for the waste gas. The coking plant is necessarily the chief installation and the zinc smeltery is an appendage.—W. R. I.]

*Director General, Societa di Monteponi, Turin, Italy.

Pyrite Deposits of Georgia

A timely report on the pyrite deposits of Georgia has just been issued by the State Geological Survey. It has 229 pages of text, a number of halftone illustrations, and a map showing the location of the principal pyrite deposits of the state, and contains a brief discussion of the geology of the pyrite-bearing area, uses of pyrite, mining methods, and related subjects, but is devoted chiefly to detailed descriptions of individual deposits from an economic point of view.

The report makes public the results of work done by the State Survey in compliance with the requests of the War Minerals Board and the United States Bureau of Mines for information regarding the possibilities of increased pyrite production. Pyrite is one of the two most necessary and important war minerals, is the principal source of sulphuric acid, and an essential in the production of food and munitions, being one of the basic materials in the manufacture of fertilizers and explosives.

The necessity for increasing the domestic production of pyrite may be realized by the fact that the United States has been importing over 1,000,000 tons a year from Spain. In order to release ships for troop movements, the War Trade Board has limited the 1918 imports to 125,000 tons, and all shipments are to be stopped after Oct. 1. The mines in the United States must therefore produce not only enough to make up this deficiency, but to provide for the increased demand for sulphuric acid, which has arisen from about 7,000,000 tons to approximately 9,000,000 tons a year, on account of the large quantity used in explosives.

Georgia has about 30 sulphuric acid plants, a greater number than any other state in the union. Most of these plants belong to fertilizer manufacturers, and the product has been used almost entirely in fertilizer. To operate all Georgia plants at full capacity would require 200,000 tons of pyrite a year, but the state has been producing only about one-tenth that amount. With its large and important pyrite deposits, there is no reason why Georgia should not be in a position to supply its own demand within a year.

The report, entitled "A Preliminary Report on a Part of the Pyrite Deposits of Georgia" (Bulletin 33), was prepared by H. K. Shearer and J. P. D. Hull, assistant state geologists. Copies can be obtained from Prof. S. W. McCallie, state geologist, by payment of 10c. postage.

Fellowships in Mining and Metallurgy

Applications for fellowships in the College of Mines, University of Washington, and the Pacific Northwest experiment station of the U. S. Bureau of Mines, will be received during the summer, it has been announced, the time for filing having been extended in order to meet the changes in personal plans incident to war service. Each fellowship has a value of $60 per month. Holders become candidates for the degree of Master of Science in Mining Engineering and Metallurgy. Graduates in science as well as technology may apply. Further information may be obtained by writing Milnor Roberts, Dean, College of Mines, Seattle, Washington.

Cornish Mining Development

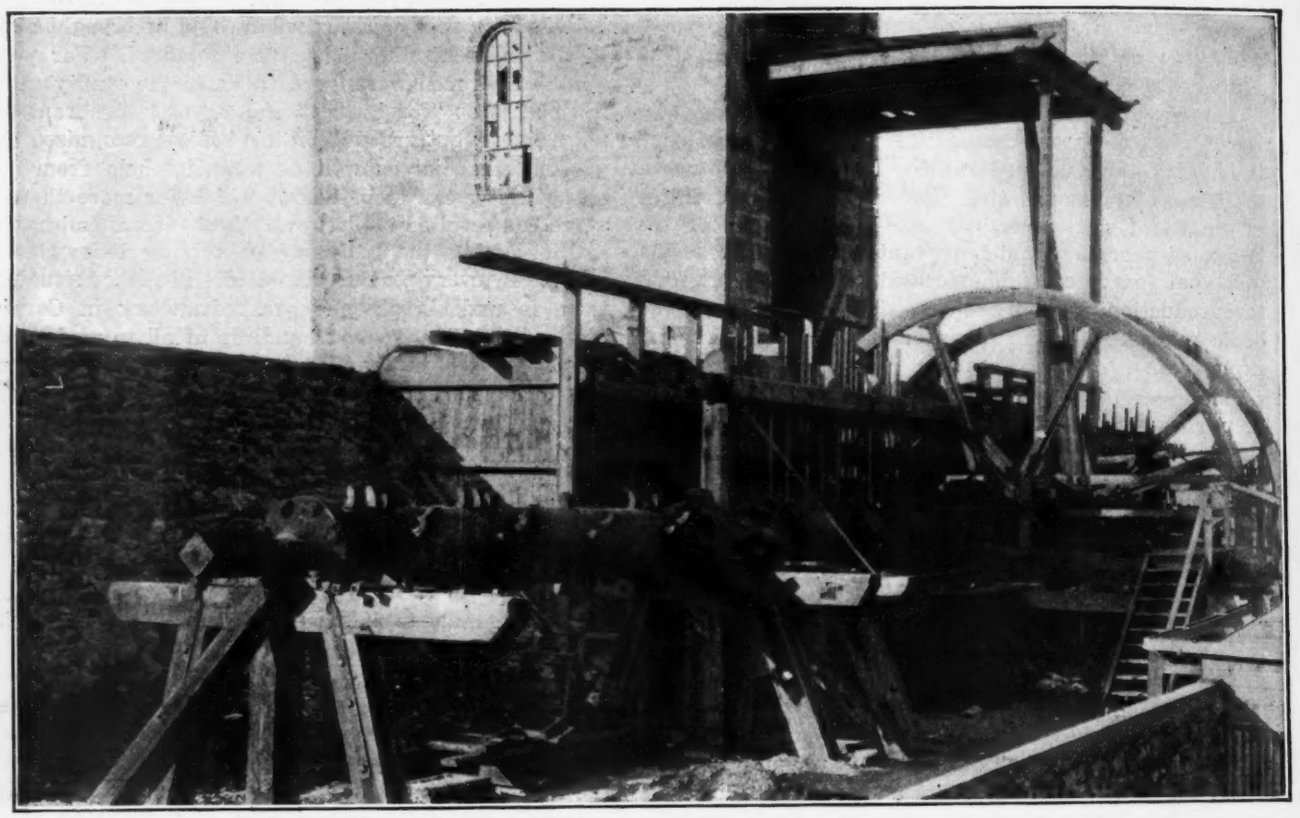
On several occasions in the last 20 years there has been talk of the revival of the Cornish mining industry. In 1907, and again in 1912, capital was raised for the purpose and booms on the stock market were engineered; but the practical result amounted to little, says the *Statist*. And yet the facts of the case justify the belief that a really great revival could be brought about if the inherent difficulties were removed. For years non-Cornish men were looked upon in the county's mining circles as "foreigners," and, as such, ignorant and not reliable; but gradually it has become recognized that without financial as well as technical help from outside nothing can stop the rot which for more than 50 years has resulted in Cornwall's best miners emigrating and becoming the mainstay of mining industries in practically every part of the world. The labor situation, then, is undoubtedly one great drawback in Cornish mining; but the greatest handicap of all to modern development is to be found in the extraordinarily irksome legal arrangements which have to be entered into with property owners before mineral-bearing areas of sufficient size can be obtained to warrant the provision of large sums for working capital.

High royalties on the gross value of the production, onerous covenants as to sinking shafts and performing other necessary work, and compensation for damage of land—such are the principal sources of complaint. Those best able to judge have come to the conclusion that the only hope of a real and sustained revival of interest in mining in Cornwall, and the consequent energetic and systematic development of its mineral resources, lies in the complete alteration of the customary conditions of leasing mining rights, or, alternatively, the reversal of the attitude of landlords, so that mining companies have the opportunity of purchasing leases outright.

In recent years some of the world's most famous mines have been evolved from discoveries made below ancient workings, and the great advance that has been made in scientific engineering and mining practice in the last 50 years justifies the assumption that, if sufficient capital and skilled enterprise can be attracted, Cornwall may again become a great tin, wolfram, and, possibly, also, copper producer. At present only about 20 mines are being worked, the majority of them small; and it should be borne in mind that, above all, present-day practice in mining, as in other industries, requires the doing of things on a big and comprehensive scale, so as to attain the highest degree of economical operation. This necessitates the ownership of large areas, the provision of solid underground equipment, the development of ore far ahead of mill requirements, and the erection at surface of expensive permanent machinery of the latest design and labor-saving capabilities. In Cornwall, progress on modern lines, far from being widespread, as it ought to be, is confined to two or three mines, and there is no doubt that the basic reason for this is to be found in the exorbitant demands and the general hampering attitude toward industrial development on the part of the landlords, including the Duchy of Cornwall.

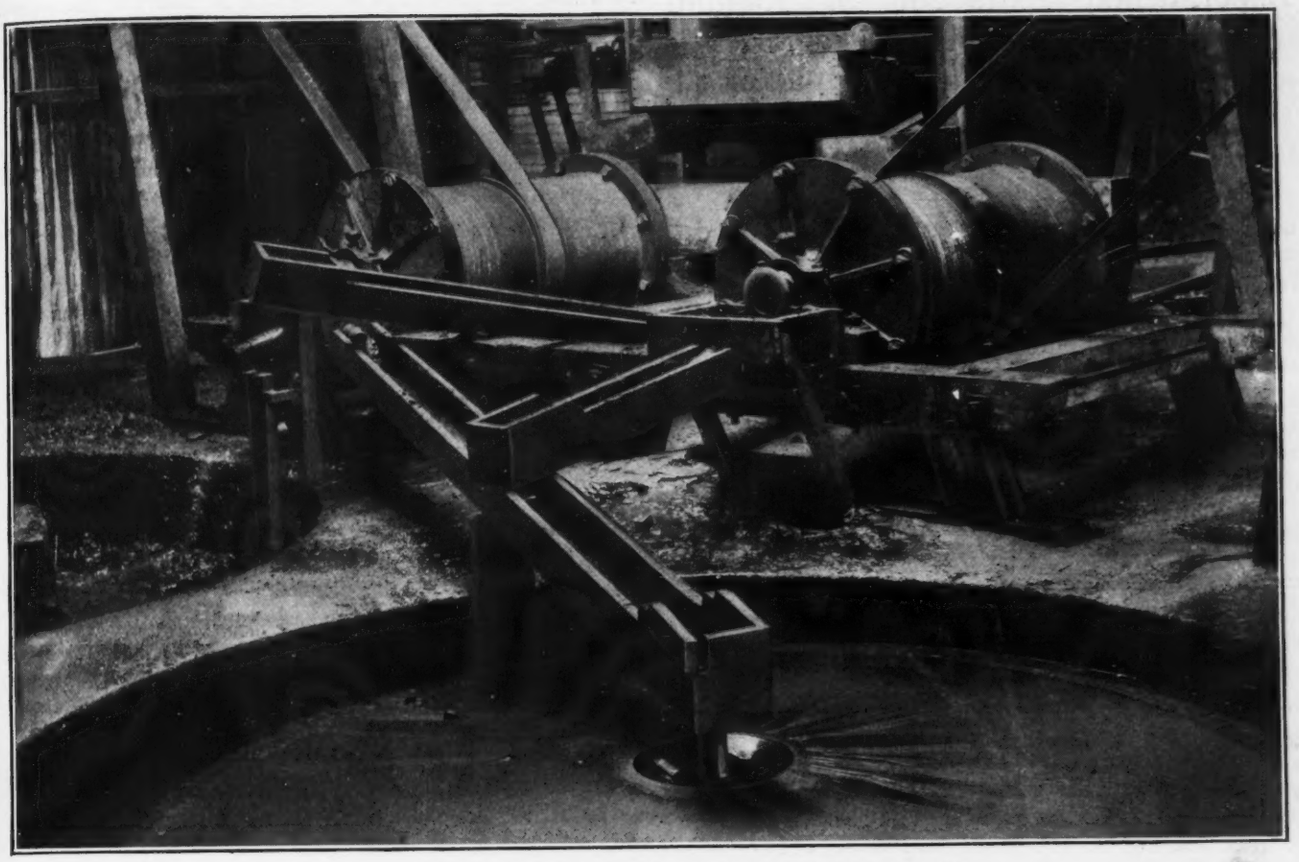
Remember the Comfort Fund of the 27th Engineers.

Tin-Concentrating Plants in Cornwall

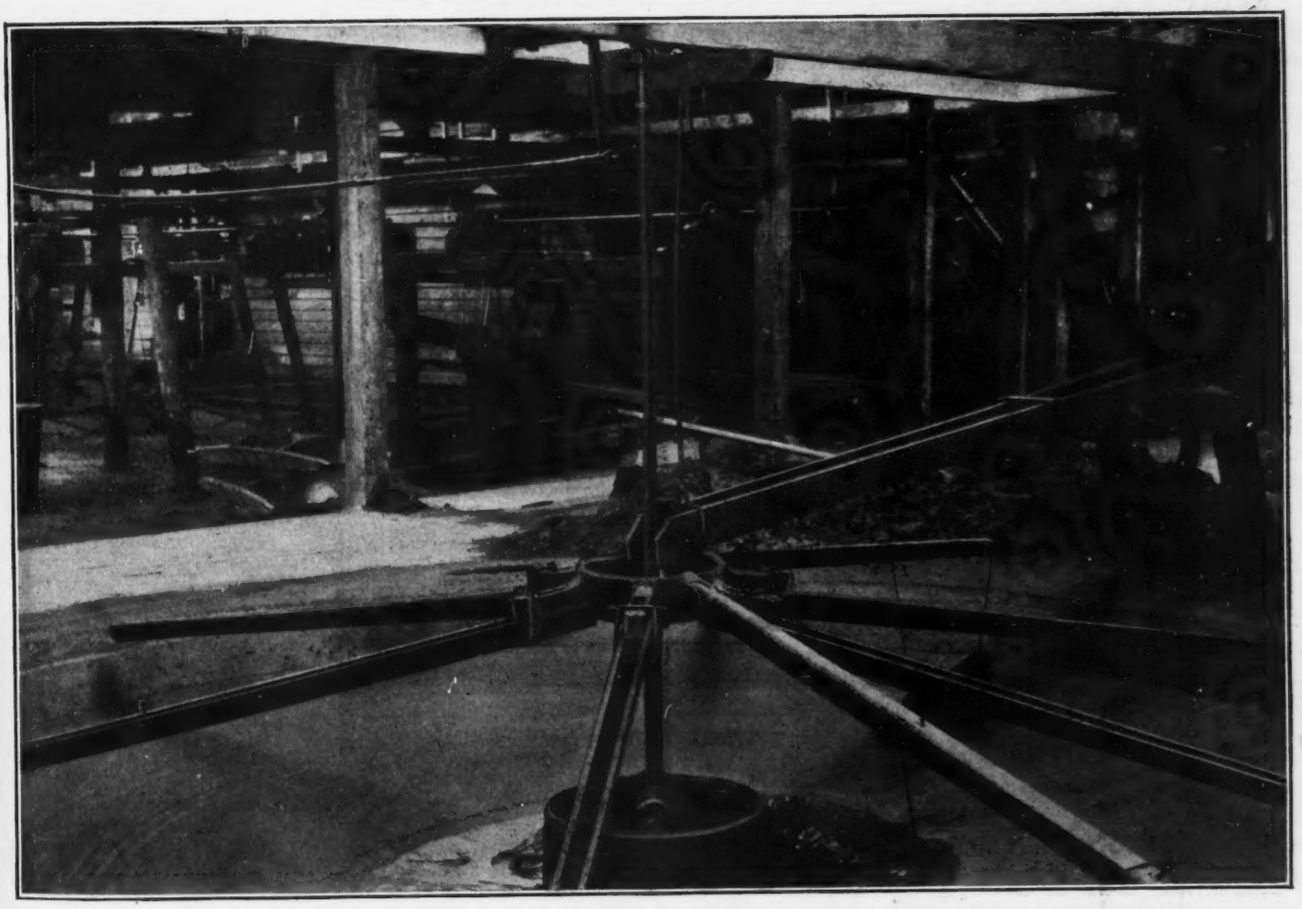


SINGLE-CYLINDER STEAM-DRIVEN BEAM ENGINE AT OLD CORNISH STAMP MILL

CLEANING TABLES AT CORNISH TIN-CONCENTRATING PLANT



REGRINDING TIN CONCENTRATES IN SMALL TUBE MILLS



CONCAVE STATIONARY BUDDLE FOR TREATING TIN CONCENTRATES AT CORNISH CONCENTRATOR

Experimental Extraction of Radium From American Pitchblende Ores By Chlorination*

By Mrs. Ray Cable and Herman Schlundt

Apparently no satisfactory method of separating uranium minerals from pyrites by mechanical processes has been developed. Concentration results in several products ranging in content of uranium oxide, U_3O_8, from 1% to 25%. The final blending gives three grades: High grade, containing upward of 16% U_3O_8; medium grade, averaging about 4%; and low grade, containing less than 2% U_3O_8. The main body of all grades, however, is iron pyrites. The experimental results here presented summarize those obtained by a new method of extracting radium by direct chlorination of the ore.

The Reaction

When the ore is heated in an atmosphere of chlorine, the principal products are S_2Cl_2, and chlorides of the metals present. The reaction of chlorine with iron pyrites takes place mainly according to the equation,

$$2FeS_2 + 5Cl_2 = 2FeCl_3 + 2S_2Cl_2$$

and is an example of one of the general methods of preparing sulphur monochloride. By conducting the reaction in a stream of chlorine gas, the chlorides of iron and uranium appear as a crystalline deposit in the cooler parts of the apparatus; and the more volatile product, sulphur monochloride, can be separated as a gas, which is easily condensed and collected in a receiver. Chlorination probably converts the radium into chloride, which, contrary to expectations, is also carried forward in the current of chlorides, only a relatively small fraction remaining with the unattacked constituents of the ore.

Upon the addition of water to the residue and anhydrous chlorides of the metal, a vigorous interaction occurs. The radium compounds for the most part remain in solution. After filtering off the small insoluble residue, the radium can be precipitated nearly quantitatively as radium-barium sulphates by adding to the filtrate a little barium chloride solution and its equivalent of sulphuric acid. The minute quantities of radium in the solutions here under consideration lie below the solubility product of radium sulphate. When radium sulphate is precipitated together with a large excess of barium sulphate, the solubility of radium sulphate under these conditions is far below its actual solubility when alone.

The Experiments

The ore, in charges of 30 to 35 gm., was spread out over about one-third the length of a 1½-m. piece of hard-glass combustion tubing of 2 cm. diameter, fitted at both ends with one-hole rubber stoppers. The ore charge was heated in a long combustion furnace. At one end the tube was connected with a tank of liquid chlorine, and at the other with a condenser and receiver. A wash bottle containing sulphuric acid was placed in the train next to the chlorine tank, and this was followed by a T-tube dipping into mercury, which served as a vent for the escape of chlorine in case the products of the reaction clogged up the outlet end of the tube. A plug of glass wool was inserted near the outlet end of the tube to stop small amounts of metallic chlorides that are likely to be swept along by the vapors of sulphur monochloride when chlorination is rapid.

The chlorination was conducted by heating moderately at first with a slow stream of chlorine passing until rapid reaction starts, which occurs before low redness is reached. The supply of chlorine was then materially increased, and the temperature gradually raised to low redness. The metallic chlorides formed are deposited along the tube beyond the heated portion, and sulphur monochloride passes on to the condenser if the cooler part of the tube is kept at a temperature above 137°, the boiling point of the monochloride. Chlorination was carried out with samples ground to pass 20 mesh. Several of the chlorinations lasted three to five hours, but in most of the experiments the flow of chlorine was so regulated that a charge of 35 gm. was completely chlorinated within an hour.

When the tube had cooled, it was taken from the furnace and the contents were washed out with water or very dilute hydrochloric acid. After boiling the insoluble residue, the tailing was filtered off, washed, ignited and weighed. The filtrates were again heated to boiling, and radium was precipitated by adding a few cc. of a 10% solution of barium chloride and an excess of sulphuric acid. Three or four days after precipitation, the sulphates were filtered off, ignited, weighed, and finally assayed for radium. The liquors were diluted to 500 cc. and samples of 200 cc. were boiled and sealed up for quantitative determinations of radium remaining in solution.

Summary of Results

The extraction of radium in the sulphates, and the loss of radium in the tailings and liquors were determined by the emanation method. The experimental results are summarized in the accompanying table.

SUMMARY OF RESULTS IN RADIUM EXTRACTION FROM PITCHBLENDE

	Grade of Ore		
	Low	Medium	High
Radium content of ore, parts per billion	3.43	8.312	49.27
Uranium content of ore, expressed as U_3O_8, %	1.20	2.92	17.45
Weight of ore used, gm	32.0	35.0	35.0
Weight of tailings, gm	3.30 = 10.32%	0.795 = 2.27%	3.53 = 10.09%
Total radium in ore sample, gm	109.8x10—9	290.9x10—9	1,724.5x10—9
Weight of sulphates recovered, gm	0.0938	0.237	0.635
Radium recovered in sulphates, gm	102.5x10—9	267.1x10—9	1,615x10—9
Radium recovered in sulphates, %	93.34	91.78	93.68
Concentration of radium in sulphates—parts per billion	1,084	1,127	2,543
Concentration ratio	316:1	135:1	51.6:1
Radium losses:			
(a) In tailings—emanation method, gm	1.954x10—9 = 1.74%	4.36x10—9 = 1.53%	56.6x10—9 = 3.29%
(b) In liquors—emanation method, gm	4.23x10—10 = 0.34%	1.49x10—9 = 0.51%	4.43x10—9 = 0.26%
Radium unaccounted for, %	4.58	6.18	2.77

Speed and Efficiency in Mine Tunneling appear to have reached a striking degree of perfection in the Northwest. The performance of the Canada Copper Corporation, at Copper Mountain, B. C., detailed in its report, in driving its main haulage tunnel, does not break previous records, but is sufficiently good to merit notice. This adit is 2903 ft. long and 10 x 11 ft. in finished section. It was begun on Oct. 10, 1917, and was finished on Mar. 12, 1918. The average advance per day of elapsed time was thus 18.8 ft. During the month of December, 645 ft. was driven.

*Excerpt from "Chem. and Met. Eng.," May 1, 1918.

Benefits To Be Derived From Close Coöperation of Zinc Mining and Smelting Interests In Helping Win the War*

By W. R. INGALLS

THE American zinc industry has been historically characterized by an alternation of ups and downs which often have been sudden and sharp. For more than a year its fortunes have been going down. Recently, with spelter selling at about 6¾c., there was a nadir of depression. There is something grotesque in thinking and talking of spelter as being phenomenally low at 6¾c. per lb., when only four years ago we often saw it at 5c. without complaining; and even did not become very much worried until the price fell below 4½c. But since then economic conditions have changed fundamentally. There have been introduced new factors affecting all commodities, which factors find expression in increased costs and increased prices. At the beginning of this year the general ratio of increase in prices was about 1.8, as compared with those prevailing just before the war. Upon such an assumption, and it cannot be far out of the way, the recent price of 6¾c. for spelter was equivalent to about 3¾c. before the war. I do not need to tell you how that would have hurt. In order to have the equivalent of 5c. spelter before the war, we should need to have something like 9c. now, and for the equivalent of 5½c. that we used to regard as a normal average, we should need to have about 9½c. now, if the physical conditions of our ore resources had remained the same. However, the physical conditions have not remained just the same, for there has been the exploitation of new, rich orebodies in Oklahoma, besides important developments elsewhere. We can see how these new factors have come into play, and have permitted so low, relatively, a price to be recorded as we lately witnessed while a large production was still maintained, but that perception does not alleviate the pinch and the pain that are felt generally in the industry or alter the recognition that the situation has been dangerous, and still is dangerous.

In fact, we have witnessed during the last 12 months a general closing down of smelting works. Many of the smelters who grew like mushrooms in 1916 have gone out of business forever. Such as now remain are those who intend to stick to the business. They have capital investments that are too large to be lightly thrown away. But even those smelters, possessing a total of about 196,000 retorts on July 1, 1918, had in use only 110,000. In other words, only about 60% of the live distilling capacity of the country—I am not including the electrolytic capacity—was in use at the beginning of this month. There were only three smelters operating at full capacity at that time, and only one of them was an important concern. Many of the other smelters, including some of the greatest metallurgical companies, were reduced to a basis of only 40%, or less. This has not been a time of the strong profiting at the expense of the weak. The strong have been blighted as well as the weak.

Not only is there this great setback in the smelting industry, but also there is the same thing in mining. If the smelters cannot easily sell their product, they cannot take ore from the mines, and the latter have also to curtail, accept very low prices, and struggle to make both ends meet. In the zinc industry, as in others, smelters and miners are in the same boat. There is not one party that lives in the cabin and the other in the forecastle, but rather is the simile that each is pulling an oar, one the starboard and the other the port, and in order to make the boat go ahead they have got to pull together. In the past they have not always pulled that way, and the boat has gone around in a circle. Henceforth your common inspiration must be to pull together, steer a straight course and get ahead.

It is unnecessary for me to review the causes that led the zinc industry into its present state. What was going to happen was evident almost from the beginning. The experience of this free, unorganized and highly competitive business during the last three years has been so true to form that its record may well be cited as one of the classics of economics. There is no use in going into the history of the past except in so far as it may afford teachings for guidance in the future. For the very reason that the recent history of zinc has been so true to form, I do not think that there is much, not previously known, that is to be deduced from it as a guide to the future. If we were going to make such a study, we might come simply to the conclusion to let the boat drift, just as we have done in crises in the past, but the time is too serious for that, and we may rightly be inspired to pick up the oars and row boldly into a new future, spurred by a spirit of adventure, not wild irrational adventure, but the kind which appeals to good sense, even if there be no bankers' guarantee of success.

I am speaking already as if the people of the zinc industry had made up their minds to do something together. I think they will so make up their minds. The prosecution of this great war, involving as it does the expenditure of every ounce of the effort of nations, has opened the eyes of everybody, as nothing ever did before, to the necessity and benefit of coöperation. Whereas former wars were matters of about 90% direct fighting and 10% engineering, the present war is about 20% fighting and 80% engineering. The engineers have to work three months or more in order to let the infantry go over the top and fight for a few days. In order that the engineers may do their work, the industries at home must supply them with material. We have learned that in order to maintain the supply of material our industries are bound to organize themselves, for in no other way can they do what is neces-

*An address delivered before the American Zinc Institute in St. Louis, July 29, 1918.

sary. During the last year iron and steel men, copper men, lead men, and others have entered into associations among themselves such as they never had before. They have become better acquainted with each other, they have learned to coöperate, and they have found this to be beneficial. I do not believe there is anybody who will say that such associations will not endure and that they will not be strengthened to meet not only the problems of the war, but also those, that may be more serious, that will come afterward. Every few days do we hear of some new industrial association to promote the common welfare, and by virtue of such promotion the welfare of the country as a whole, which stands on its industries just as a chair stands on its legs.

The prime and immediate question that is before this meeting is What can an association do for the zinc industry? At once let me say that many people can do together what no one can do alone. The great thing for the zinc producers, acting jointly, to do at this juncture is to engage in efforts to increase the use of zinc. If there be any other salvation for the industry, I cannot think of it. You possess mines, mining plants, and smelting works with a great excess of capacity over any use that there is at present or that is in sight. Your smelters could produce 800,000 tons of spelter per annum, and they are now producing at the rate of about 500,000 tons. The change in conditions has been so kaleidoscopic during the last four years that I scarcely venture to indicate the capital value of that 300,000 tons of surplus capacity. Some of it was paid for under pre-war conditions; some of it at the higher prices that subsequently prevailed. Some of it is in natural-gas plants and some of it in coal-fired plants, which are more costly. But if I should generalize the capitalization of that capacity, not in terms of replacement value but rather in terms of its brick and steel and labor when built—if, in other words, I should estimate its cost at $10,000,000—I think that my estimate would be conservative.

The value of idle mining and milling plants I hesitate even to guess, but it also must be large. In the six states comprising the Wisconsin and Joplin districts, including Arkansas and Oklahoma, there was a milling capacity in 1914 of about 10,000,000 tons, and nearly that quantity of ore actually milled. A record that I have caused to be compiled shows that 120 mills, costing about $6,000,000, and possessing a capacity for about 13,000,000 tons of ore, were built during 1915, 1916 and 1917, and doubtless that record is incomplete. But, anyhow, the miners of these six states actually milled upward of 19,000,000 tons of ore, or dirt, if you please, in 1917, and my estimate of 23,000,000 tons of milling capacity of an original cost of $9,000,000 at the end of 1917 is none too high, except for such portion of it as has already been abandoned and written off. Since then more mills have been built, especially in Oklahoma. How much of this milling capacity is now idle, I scarcely venture to guess. I can hardly say that it is the same ratio as smelting capacity, for the smelters never maintained their maximum for a whole year; and, moreover, their use of imported ore was radically reduced; but, nevertheless, it is obvious that a present production at the rate of 500,000 tons of spelter per annum, as compared with 680,000 tons in 1917, means the use of a correspondingly less quantity of ore and a reduction from the 23,000,000 tons of milling capacity in the six states. Bearing in mind that these states accounted for only 50% of the country's production of spelter in 1917, and that I am talking only of milling capacity, not of mining plant and the mines themselves, I may venture to say that the capitalization of the idle mining and milling capacity of the American zinc industry today is at least equal to that of the idle smelting capacity and may we therefore say $20,000,000 for the industry? This figure is very rough. I am trying merely to afford some indication of the magnitude of the problem so that we may view it and discuss it with the proper perspective.

Now, much of this surplus capacity is destined to become moribund and eventually to be thrown away unless some use be found for it, and I cannot think of any use, save to a small extent in making sulphuric acid, except in the production of zinc. A large part of your profits in 1915-17 is tied up in this plant, and there may turn out to be no profit at all unless you do something. At the least, this capital is at present earning nothing. Indeed, the predicament of the industry is worse than that. For a greatly increased number of concerns, both mining and smelting, have become participators in the business. Not only has a greatly increased plant been capitalized, but also a greatly increased administration of the business; wherefore there is an expanded overhead. Consequently, many of your plants, operating at only 40% capacity, are showing the increased cost per ton of ore smelted that inevitably follows from operation at reduced capacity. I suppose that some have even reached the stage of resignation where they may philosophically reason that the less ore that is smelted the less money may be lost in the aggregate, even if the loss per ton of ore be more. Many mining companies no doubt are deluding themselves with the fancy that they are just breaking even, when in fact they are not really getting a new dollar for an old one.

With this disagreeable and unhealthy situation in the zinc industry, we find that at the same time the country is in desperate need for many of the other metals. The shortage of tin is acute; of copper there is not enough; nor is there of iron and steel. In the lead industry there are ominous clouds. In zinc only, among the major metals, is there plenty. Manifestly, every pound of zinc that can be substituted for the scarcer metals at this time is a patriotic service. Incidentally, it will be helpful to the zinc industry itself.

I should take too much of your time if I should begin to elaborate to you my ideas as to the more extensive uses of zinc that may be made, and my ideas at present are but imperfect, anyhow. I will confine myself to general principles. Most metals have some uses that are peculiar to themselves, owing to special properties; i. e., such as those that make copper valuable as an electrical conductor and tin for solder. Other uses are due merely to certain general properties, such as malleability or ductility, which make them capable of being rolled into sheet or drawn into wire. For many purposes sheet zinc may serve just as well as sheet copper, or a zinc casting may be quite as good as brass. In some cases zinc may be really better than some other

metal that is commonly used, owing to tradition or habit, but the manufacturing and consuming trade may not know it. I have not the least doubt that zinc can advantageously be employed for a great many more purposes in this country than it ever has been. Even before the war it was employed for more purposes in Europe than here. Since the war it has been employed in Germany for more purposes, in substitutions for other metals, than anybody ever thought of previously. If we wait for the war to be over, we shall learn some marvellous things of what the Germans have done with zinc; but that will be far too late for us. We ought to get busy to learn things and to push things for ourselves. This is the psychologic time, right now, when zinc is plentiful and cheap and some of the other metals are scarce and dear. Obviously, those that are scarcest and dearest are the ones to go gunning for first. A multitude of consumers will be interested in substituting the cheap metal for the dear ones if they be shown how to do it, and in showing them the industry will not only be helping itself, but also will be performing a national service.

History has a curious way of repeating itself. Did many of you ever pause to think that zinc is commercially a relatively young metal? The ancients did not know it at all. The Chinese had it, probably in only a small way, several hundred years ago, but the production in Belgium was not begun until 1807. Then for many years the industry was only a trifling and struggling affair. There was no broad market for the metal. The people did not know what to do with it. It was not until Dominique Mosselman, a man of vast energy, entered the business in 1818, just 100 years ago, and devoted himself to establishing a market for zinc by educating the people in its uses, that the industry could be said to have its commercial birth, and even at his death, in 1837, it could scarcely be said to exist in the west of Europe except in expectancy. We are therefore confronted now with the same problem as Mosselman and his successor—the Vieille Montagne company— viz., the creation of new uses for the metal.

The promotion of the use of zinc is, in my mind, the main thing for an American Zinc Institute to consider. I do not want you to be under any illusion that great accomplishments are to be expected overnight. It is, on the contrary, an enterprise that should be entered upon only with patience and broad perspective and not too rosy expectations that it will make you everlasting fortunes. It may, it probably will, be slow in showing results. The results may be obscured by offsetting adversities. The results may be mainly in keeping the industry from passing into a worse state than it is in now. About the only test of results will be what is shown by the statistics of production and consumption, and even they will not be infallible indices. It is going to require a lot of hard work, a lot of time and a lot of money, but nevertheless it is going to be a good thing to do. As to the time and money that ought to be contemplated, I shall revert subsequently.

But while this proposed promotion is being instituted and is going on, I can think of some other things that may beneficially be undertaken, some of which will have earlier results, and not by any means results that will be only small. One of these is better statistical service.

Now, the zinc industry has not been destitute in the past of knowledge of what has been going on within itself, as revealed by statistics. On the contrary, I think that this industry, thanks to the coöperation of all the producers and their appreciation of the benefits accruing, has been rather better served in this respect than other metal industries have. But even at the best, our statistical reports are only imperfect pictures, and they are capable of great improvement, to the great advantage of everybody in mining and manufacturing, in buying and selling.

We have been hearing recently a lot of talk of how the Germans captured the metal business of the world; of how the British and lately ourselves have broken their hold by the seizure of their concerns. There has been a lot of buncombe in this. The Germans may have captured the metal business of the Continent, but of the world they never did. Such a charge is too absurd to talk about. Yet it is true that over a long period of years the Germans have bought American copper more cheaply than have our domestic consumers. It is true that previous to the war, on those occasions when we have had a surplus of spelter and have had to export it, the sales could only be made at a painful sacrifice. It is true, moreover, that in trading in metals the Frankfurt houses and their affiliated concerns have made a great deal of money. How were they able to do that? Why, simply by knowing more of conditions than other people; by taking the trouble to know more; by knowing when to buy and when to sell. My friends, our grievance that Germany, or Europe, has bought our copper and spelter more cheaply than have our own people boils down to that. Only a few days ago I read an extract from a German paper complaining of how the American copper magnates had been arbitrary and ruthless in what they had made German manufacturers pay for copper.

Now, how did the German trading houses acquire such a powerful knowledge? They acquired it by study, and by organizing adequate intelligence services, and by collecting and publishing and analyzing statistics. Many of you know the painstaking and comprehensive statistical pamphlet that the Metallgesellschaft used to issue annually. Do you think that that work was done for the fun of the thing, or to enable some one to ride a hobby? Not at all. It was one of the German means of aquiring knowledge that was stupendously useful in the business.

I am bordering upon a subject that is far broader than what comes within the scope of the zinc industry alone. I must confine myself to some general features. Unless we profit from the German experience, we shall not put ourselves very much ahead. If we sit idly by, some one else, after the war, will get ahead of us, just as the Germans did before. This is the time of all times to seize upon this idea. For a while the Germans are not going to be able to collect international statistics. Animosities will prevent. But if we do not do it, some other rival will do it, and will get the advantage.

On this subject let me quote the following from a letter to me by one who knows whereof he is talking:

"It is important not to leave this field to our French and English friends. It has been one of the cornerstones of German metal power, by giving them a world-

embracing picture of production and consumption. Through it they were often ahead of all others in recognizing changing conditions. The United States is entitled, by reason of its production, to be the metal center of the world, and not Germany or England. One of the steps in this direction would be first-hand information. The other, of course, is international organization by Americans both for buying and selling materials. This is one of the things we can learn from our enemies."

Here you have again the international aspect. Whether we want to or not, we have got to open our eyes to it, and be governed in our actions by what we see. The zinc industry of this country is no longer going to be provincial. It is going to be national, and it is going to have serious international problems and complicated relations, which are going to be uncomfortable to us unless we are prepared to face them properly. We have got to know what is going on in Great Britain, in Australia, in Japan, where there are rival producers, and in the South American and other markets where competitors will meet. In other metals there will be similar problems, and there will be formed similar associations, both here and abroad, which, among other things, will do their own necessary statistical work. The several bureaus will in some way be brought together in some international form. But I can tell you, based upon no trifling experience, that with proper backing and proper execution we—I mean we Americans—can do our statistical work, and do it better than Frankfurt ever dreamed. Without waiting, however, for that ultimate development, the American zinc industry ought to get busy with its own. That will be of more aid to you, and more quickly, than anything you can think of unless you have my imagination. This is one of the things that the American Zinc Institute can accomplish right away with the promise of some early, beneficial results.

Another thing to which the Institute may well direct its attention is the education of its members to what is a proper basis of accounting, which may well be evolved into a uniform system. You will forgive me, I hope, if I remark that, without any doubt, you—both miners and smelters—are at sixes and sevens with regard to this fundamental subject. A lot of you think you are making money who really are not. Others of you who are really making money are not doing so well as you ought to. Some of you who are losing are losing too much. There can be no real efficiency in your business, nor in any other, without a thoroughgoing system of accounting. I know that some of your leading metallurgical companies, which have what they consider to be perfectly elegant sets of books, are lacking in a good deal of the elemental information they ought to have, or else they do not possess it in the form they ought to.

In advising you to give thought to this matter and in emphasizing the importance of it I make no pretense to being original. It was the one great lesson that Edward N. Hurley learned during his ministry as chairman of the Federal Trade Commission, when he had unusual opportunity to examine the accounts of American industries; and he has been preaching it ever since. Only a few days ago he was addressing a national association of coal operators, lately formed to coöperate for the general welfare, just as you want to do, and in the course of his remarks he said this, which I can do no better than to repeat:

"It seems to me that one of the most important things your association can do is to begin active preparations now to increase your efficiency so as to maintain the production of coal at the highest possible level. You have taken the first step in this direction by working out a uniform system of cost accounting and by organizing a cost-accounting department to assist mine operators to put their business on a sound basis. In every trade association the strong must help the weak, and in most cases the weak are those who know the least about their own business. Accordingly, the first move to strengthen your industry is to teach those weak producers the facts about their own conditions. Coal should be mined at a profit, but no man can know whether he is really making a profit or not unless he knows his costs.

"Profits are not all, however. No man can know whether his organization is really efficient or not unless he knows his costs and unless he has some standard of costs, either the average for his field or the figures of the lowest producer, which he can use to compare with his own. It is vital to us all to develop the highest industrial efficiency of which we are capable today. In one sense, this whole war is a test of industrial efficiency. Thoroughgoing cost accounting is the very basis of efficiency in your business, as in every other business."

This association of coal operators has already begun to do that very thing. I am prepared to adopt Mr. Hurley's words and substitute zinc for every time he said coal, and to assure you that the advice is wise. With proper cost accounting, preferably on a uniform basis, you will know what you individually are doing, either in mining or smelting. With proper accounting at the sources of production, the collection of statistical data will be easy. With the right kind of statistical service, you will know what the industry is doing as a whole. You will be able to sense coming events. You will be able to form better judgment as to when to buy and when to sell. You will be able to deal with your laboring men in a more intelligent way and ameliorate your labor troubles, and the last is surely one of the great problems that confront you.

Do you ask me how statistical knowledge may ameliorate labor troubles? Well, I was asked quite recently to supply some statistical information in just such a connection. There was a strike based on claims of increased cost of living, which statistically it was easy to refute. Our employees are not always unreasonable. We are prone to make the mistake, when our employees murmur and strike, that they have no good reason to do any such thing. Often they have not, but sometimes they have, and we are apt to be blind to it, and perhaps unreasonable ourselves, until it is too late. But either way, the administrator of a business is wonderfully fortified if he knows just what the industrial situation is, what is the relative efficiency of labor, what are the costs of living, what is the prevailing scales of wages. I say if he knows, and does not merely conjecture, or perhaps not think of things at all.

On the subject of labor, that is surely going to continue to be one of your great trials and tribulations. It is going to be so in every industry. The only answer for a long time is going to be improvement of managerial efficiency and increased mechanicalization; the substitution more and more of machines for men. The American Zinc Institute may well make it one of its functions to examine critically the management of the mines, mills and smelteries of its members. A large percentage of the inefficiency in production of all commodities is poor management. Perhaps our great copper-mining industry is more free from that charge than any other, but even in it tremendous improvements are being made all the time. You might well consider the appointment in each district of a committee on efficiency for the purpose of exerting efforts to improve the performance of the management of mines in that district. In what better way could you help the Government at this time? Even if the Government may not want from you just now any more zinc than you are producing, it certainly wants all that you can possibly do in the way of paying taxes and subscribing for bonds, and how better can you render that aid than by increasing efficiency and saving?

I might outline other things for you to do, but I fear lest I weary you. We hope that we can so promote the American zinc industry that after the war we shall have a noble export business, both in crude metal and in manufactures. It will be necessary to consider joint action in meeting foreign competition, which now, by the terms of the Webb law, is legal. We ought to consider educational steps for our own common benefit besides those which I have previously indicated. We may well contemplate the nature of relations with manufacturers in this country, the consumers of our product. But these and other interesting possibilities may be postponed for discussion at another time.

My main recommendations to you, therefore, are steps to increase the use of zinc in this country, and steps to increase your efficiency in both production and selling, among which are statistical service and the organization of a good system of uniform accounting. The big thing, however, seems to me to be to increase the use of the metal. If you are going to carry out this program, you must make up your minds to undertake it in a big way. You must have patience and a proper sporting spirit. The leaders whom you choose must have judgment, inspiration and bold imagination. Without imagination they cannot accomplish much that is worth while. They must have visions and must make them come true. There is no use in thinking of undertaking the job in any picayune or mediocre way.

I cannot outline any budget to you. There will be need of a staff of good men. I think a dozen might be put advantageously to work about as rapidly as they could be secured. You will need a laboratory, or laboratories, for testing purposes. You will have to issue publications to reach the people you want to convince and also to apprise your own members of what is going on. You will have to advertise, which may cost a great deal of money. No one can intelligently forecast all of these expenses, and others, at the present time. But if you contemplate spending $200,000 per annum for the next five years I do not think that would be any too much. It is a big job that we are discussing. After all, the sum that I have mentioned is only about 1% of the capital that is tied up in idle plant at the present time.

I have not, perhaps, stuck very closely to my theme of what the zinc industry can do to help the country win the war. It is my conception that the industry by helping itself can best help the country. If the industry can induce the people to use zinc more freely, and thereby release scarcer metals that may be more especially required for munitions; and if the industry can increase its own efficiency in production; and if, then, I be asked "What else can it do to play its maximum part?" I shall find it difficult to offer any answer but "nothing more."

Strontium in 1917*

BY JAMES M. HILL

Approximately 4035 short tons of strontium ore, valued at about $87,700, of which about 10% was strontianite (strontium carbonate) and the remainder celestite (strontium sulphate), was mined in the United States in 1917, in California, Texas and Washington; and about 1700 tons of English celestite was imported.

The principal market for celestite and strontianite is in the East, the largest buyers apparently being the Foote Mineral Co., of Philadelphia, and E. I. du Pont de Nemours & Co. (Harrison Works), also of Philadelphia. The Beckman & Linden Engineering Corporation, of San Francisco, and a firm in Seattle are also buying strontium ores.

Prices reported by sellers of celestite ranged from $20 to $22 a short ton, but for strontianite ores prices from $35 to $90 a short ton were reported. The Foote Mineral Co. on July 14, 1917, was selling ground celestite (90% $SrSO_4$) at 2c. per lb. ($40 a ton) and ground strontianite (83% $SrCO_3$) at 7c. per lb. ($140 a ton).

Four companies in the United States reported sales of strontium carbonate and strontium nitrate in 1917, aggregating about 3,000,000 lb., or 1500 short tons. The principal salt sold was the nitrate in addition to a few thousand pounds of strontium bromide, and several thousand pounds of sulphide, which was presumably used for making other salts.

The demand for strontium salts comes principally from makers of fireworks and night signals. Quotations on strontium carbonate[1] have been steady throughout the year at 40 to 45c. per lb. for technical carbonate and 55 to 60c. per lb. for pure carbonate. Strontium nitrate was quoted at 42 to 52c. per lb. at the beginning of 1917, but declined to 25 to 30c. per lb. in June and remained at that figure till the end of the year.

Australian Copper and Tin go, to a large extent, to Great Britain and other ally nations for the making of munitions. In 1916 about 39,300 tons of copper was produced, of which 26,340 tons was shipped to Great Britain and 9530 tons to her colonies and Allies. About 5590 tons of tin was produced in the same year, and of this 4750 tons was exported, of which about 2180 tons went to Great Britain and the remainder to the Allies and the dominions.

*Excerpts from "Mineral Resources of the United States, 1917." Part II.

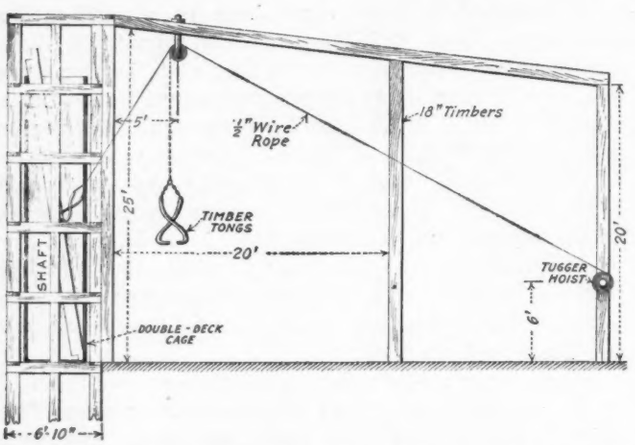
[1] "Oil, Drug, and Paint Reporter," Vols. 91-92, 1917.

Details of Practical Mining

Lowering Shaft Timbers

By C. T. Rice

Shaft timbers are often lowered into the mine from the surface by swinging them under the bottom deck of the cage, but this practice frequently gives trouble, for the square daps cut in the timbers are likely to catch on the shaft sets while being lowered. When this occurs, something generally is broken before the hoist can be stopped. At the Hecla mine, Burke, Idaho, a good method of lowering shaft timbers to the level from



ARRANGEMENT FOR LANDING SHAFT TIMBERS AT UNDERGROUND STATION

which the sinking is being done has been devised. It consists of removing the top deck of the two-deck man-cage and lowering the wall- and end-plates on the cage with the tops of the timbers extending through the hood. Owing to the construction of the cage (the top deck is held in position on supporting angle-iron ledges by four pins), this change can be made easily and quickly.

At the station where timbers are to be landed, a block is secured in the roof about five feet back from the line of the shaft. Through this pulley is a wire rope provided at one end with timber tongs and fastened to a Little Tugger hoist, which is clamped to one of the posts of the station timbers. In landing the wall plates so that they will not be injured, the timber tongs are nipped into the wall plate about the middle. After the Little Tugger hoist has taken most of the weight of the timber, a shaftman sinks a picaroon (a pick would serve the purpose, but not as well) into the wall plate near its bottom and walks out in the station with the end. As he does so, the drum of the hoist is slacked off and the wall plates are lowered gently upon the station. In this manner the shaft timbers are lowered at the usual hoisting speed without danger to the shaft, and are landed easily and quickly, without injury, on the station floor.

Dog for Lowering Mine Timbers Into Stopes

Timbers occasionally get away while lowering or hoisting into stopes, even when a chain is used on the rope to grip the piece better. This is especially true if the timbers are wet or icy. At the Hecla mine at Burke, Idaho, much heavy round timber has to be either lowered or hoisted into the stull-set stopes. The caps are green timbers and average about 14 in. diameter and from 7 to 16 ft. long, and the posts are about 8 ft. long and of 10 in. diameter. These rather heavy timbers are, nevertheless, handled safely and easily, and got into the stopes by using dogs and chains on the ropes.

A chain such as is frequently used on the end of a timber rope is spliced to the cable, and the weight of the timbers requires an air hoist. Instead of having a ring at the end, this chain, which is much longer than the chains ordinarily used, has a strong clevis, which serves a double purpose. When timbers are being hoisted into a stope, it is used to fasten the chain to itself after it has been wrapped several times around the stick; when lowering timbers, the clevis is used to fasten to the chain a ring that has several timber dogs secured by short chains. In lowering timbers, reliance is placed

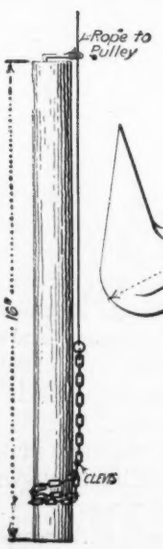


FIG. 2

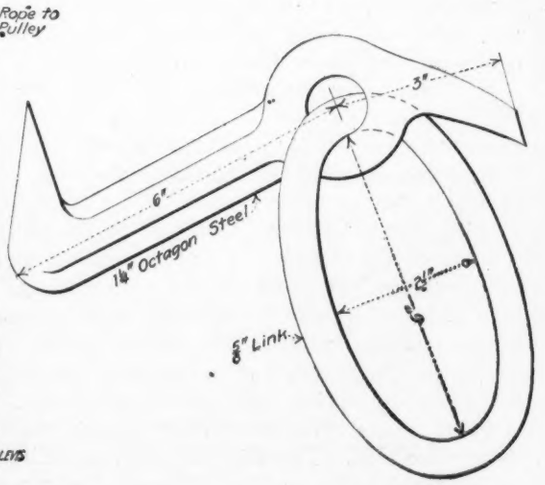


FIG. 1

TIMBER DOG AND MANNER OF FASTENING TIMBER

entirely upon the dogs, several being sunk into the stick if it is large.

The timber dog shown in Fig. 1 is made of 1¼-in. steel and has an ordinary timber-dog point at one end, and at the other it is bent back. When it is desired to take the dog out of a timber, all that is necessary is to hit the dog on the bent end so as to pry it out. About two-thirds the way from the dog end, the drill steel is flattened and a hole about an inch in diameter is punched

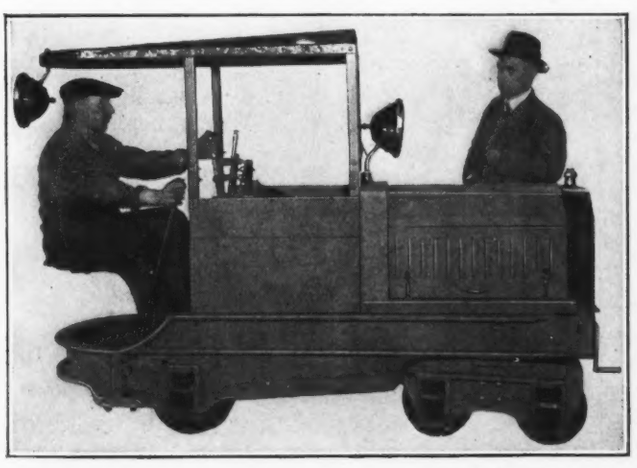
through. A long narrow link made of ⅜-in. steel and large enough to slip easily back and forth over the rope chain is then put through and welded.

In hoisting timber, the dog is fastened loosely to the cable by means of this link. First the chain is wrapped several times around the timber near the bottom and fastened to itself by the clevis. Then the dog is slipped up along the cable until it can be sunk into the top end of the stick. When the top of the timber has been hoisted level with the landing floor in a stope, a picaroon is applied and the dog at the top knocked loose. Then, as the timber is hoisted further, the top end skids out on the floor, and the stick is guided by means of the picaroon to the place where it is to be used. Fig. 2 shows clearly this method of landing timbers.

In lowering the timbers, a ring to which four dogs are fastened by short chains is used. If the timber to be lowered happens to be large, it is lowered singly and with three dogs. If the timbers are small, several are lowered at one time, a dog being sunk into each near the top. Whether the timbers are lowered singly or several at the same time, they are fastened only at the top, so that as soon as the floor is reached they can be landed easily by the use of a picaroon applied at the lower end, the workman walking out into the stope with the timber. Thus when lowering as well as hoisting timber, the bulk of the weight is kept on the cable, and the work of landing a heavy piece is reduced to a minimum.

The Ford Mine Locomotive

The illustration shows one more use to which the universal Ford motor has been put and its adaptability for underground haulage problems. The locomotive was built by the McFarlane-Eggers Machinery Co., of Denver, and is now operating in the Royal Flush mines, of Columbine, Colo. Details of the body are apparent from the illustration. The locomotive has a four-wheel fore truck which is pivoted to the frame. The frame consists of three iron castings, on which the well-known bonnet and a wooden cab and seat have been mounted.



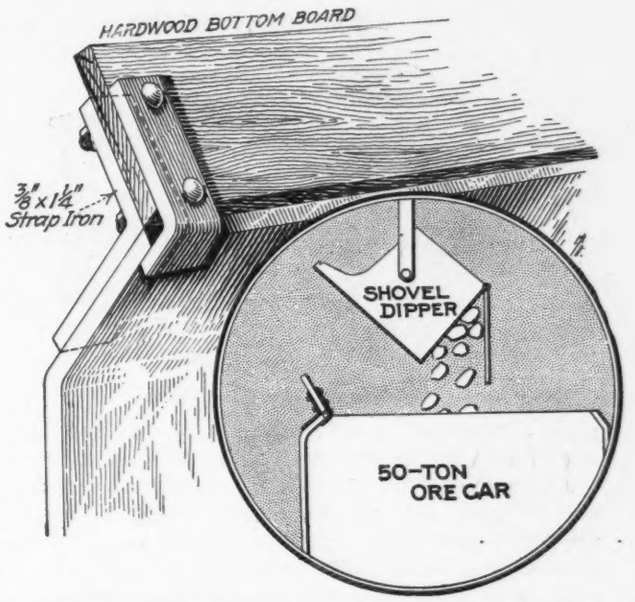
THE COMPACT AND USEFUL FORD MINE LOCOMOTIVE

The locomotive shown operates over an 18-in. gage track and will negotiate an 8-ft. radius curve. It is 30 in. wide, 7½ ft. long and weighs 2500 lb.; and the overall height at the cab is only 4 ft. The locomotive travels at a speed of 10 miles an hour and will draw from six to eight one-ton cars. This adaptation of the Ford motor will undoubtedly solve many problems in small outlying districts heretofore handicapped by the necessity of choosing between costly hand tramming over long distances or expensive and unwarranted haulage installations.

Use of Side Board in Loading Cars

BY HALE H. HUNNER*

In loading the stockpile at the Ferro mine of the Onahman Iron Co., on the Cuyuna range, in Minnesota, the main line running to the shaft was used as the loading track in making the first cut. The toe of the pile reached to within five feet of the track rail and had been riprapped about five feet high. On the opposite side of the track the embankment extended on the level about two feet beyond the end of the ties and then sloped off abruptly into a borrow pit about eight feet below the grade of the track. This slope was covered with pieces of rock that had been trimmed from loads, as well as a considerable tonnage of high-grade ore in large pieces and fines that had fallen from cars in previous seasons. To recover much of the ore thus spilled would have cost more than it was worth, as it was so underlaid with sand and rock that it was impossible to shovel it. The new spill from the dipper teeth was equally hard to recover.



DETAIL OF SIDE BOARD USED IN LOADING CARS

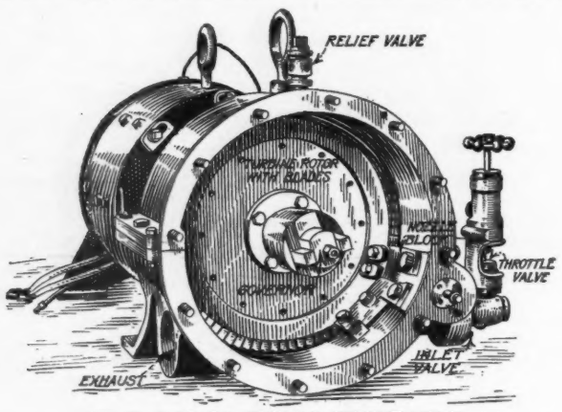
I tried the use of the movable side board shown in the illustration and saved from two to three tons in a day's loading. When a car was about half full, the board was put in position on it by two of the pitmen. When the car was loaded, the pitmen shoveled enough ore away from the board to enable them to drag the remainder up the side of the load as they removed the board. As the railroads were demanding maximum loads, the car spotter always saw that the board was used. There was no delay due to shifting, as this was done between shovel dips. By the time the two pitmen could trim the car and have the board ready to shift, the next car would be full enough for the board to be placed on it.

*Onahman Iron Co., Ironton, Minnesota.

Mining and Metallurgical Machinery

Small Turbo-Generator Unit

The Westinghouse Electric & Manufacturing Co. has recently produced a small turbo-generator unit for direct-current service. This unit is designed for 10 kw. output, although a temporary load of approximately 12.5 kw. may be obtained. A smaller unit of 8.5 kw.



W. E. & M. CO. TURBO-GENERATOR

gives a range of capacity suitable not only for lighting work, but also for the many electro-magnetic purposes.

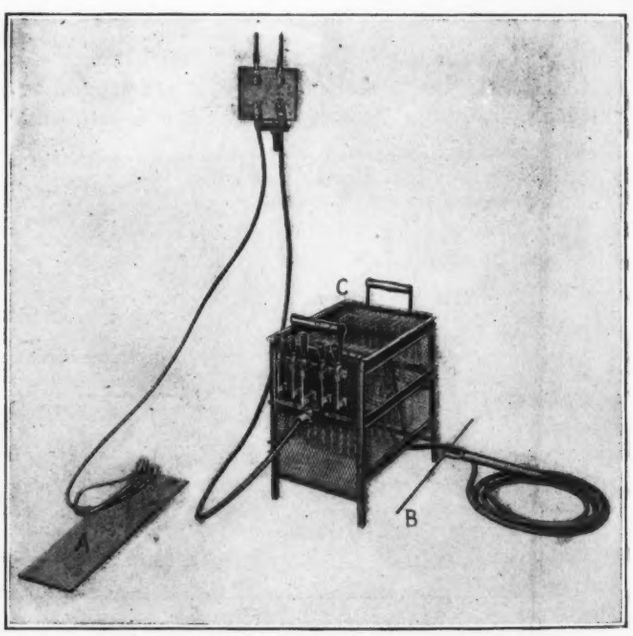
Among the fields of service for which it is adaptable may be mentioned surface mining, where flood lighting for night work has come into general use. Its range of operating conditions (80 to 235 lb. inlet, and from 0 to 10 lb. back pressure) makes this a suitable unit for other purposes. Since the energy developed is direct current, the installation is finding favor for use on steam locomotive cranes where the current is used for lifting-magnets. Many of these cranes are now equipped with electro-magnets, and this addition enables the purchaser to have all the advantages of the electric locomotive crane for handling scrap iron in electrolytic refining and elsewhere. Its construction is such that it can be used at considerable distances from machine or repair shops. There are no reciprocating parts to wear out; and, apart from filling the oil well occasionally, no further attention is needed.

It is simply constructed and possesses many of the features found in larger units. Among these is a hand and automatic throttle valve, and an emergency overspeed governor, placed on the generator end of the unit, which automatically closes the throttle valve of the turbine if the unit should show a disposition to overspeed. The device consists of a small weight placed in the shaft of the unit which, when the predetermined speed is reached, engages a trip lever connected in such a way to the throttle valve that it is then automatically closed.

The most important feature of this unit is that it has but one revolving part, the generator shaft being extended so that it also carries the turbine rotor. This not only makes a very compact machine, but eliminates all coupling and alignment troubles, and dispenses with turbine bearings and packing. The turbine rotor is made of an openhearth steel forging in the periphery of which are placed blades of electric furnace steel, which are held in place by pins tightly driven in through blade and rotor. The blades are of the impulse type, and although there is only one row of blades, yet by means of a reversing chamber the same steam is passed through the blades a second time, thus allowing complete expansion of the steam. Since the unit is designed to occupy the least possible space, the manufacturer has equipped the generator with ball bearings (no bearings being required on the turbine other than the usual type of surface bearing), thus effecting saving in bearing friction, while a decrease in length and weight of the unit is possible. The complete model is 3 ft. 8½ in. long, 23 in. wide and 18¾ in. high, and a unit, with cover removed, is illustrated herewith.

Arc Welding With a Portable Rheostat

The electric welding outfit shown in the illustration consists simply of a portable rheostat *C*, a contact plate *A* and a welding point *B*. The rheostat and contact plate are connected in circuit with a two-pole switch. The plate *A* is placed in contact with the object to be



ELECTRIC WELDING OUTFIT AND RHEOSTAT

welded, and the point *B* applied in the ordinary manner to the joint to be welded.

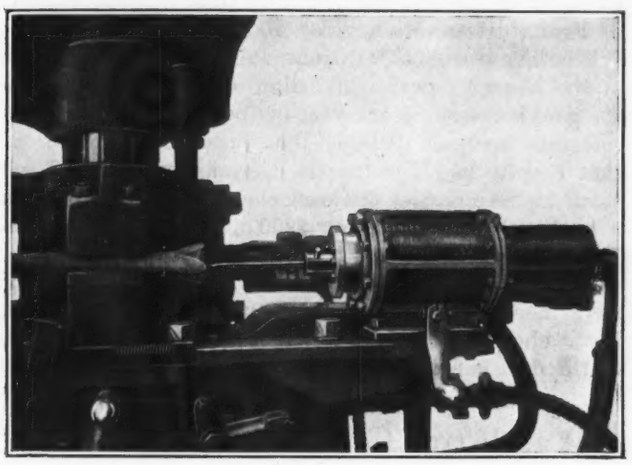
The illustration shows a rheostat adaptable for a 150-ampere, 110-volt circuit and it weighs only 16½ lb. without the leads. The overall dimensions are 20½ x 15 x 12 in., and it is easily portable to any part of the plant. The current is regulated from 15 amperes up to

150 amperes, in steps of 15 amperes, and is suitable, consequently, for all kinds of welding with a metallic pencil.

The Electric Railway Improvement Co., which has put this equipment on the market, also manufactures rheostats for 150 amperes and 220 volts. The great advantage of an outfit of this kind will be readily appreciated by welders and machinists, as its portability, combined with flexibility, affords a great advantage over the old type of electric welding equipment.

Drill Steel Puncher

The Denver Rock Drill Manufacturing Co., Denver, Colo., has just placed on the market an efficient pneumatic device for opening the hole in the end of a piece of steel while being worked into a bit or lug. It is called the Model 10 Waugh Steel Punching Machine and is designed to be mounted on the pedestal of their Model 8 Waugh Sharpener directly in the rear of the



WAUGH STEEL PUNCHING MACHINE

vise jaws, as shown in the illustration. The punch is held in a tappet chuck and is hammered into the steel as it is fed forward by an air-feed cylinder. The operation is simple and the machine will open the water hole in a shank or bit in a fraction of the time required to do it by hand. The device may also be mounted on a separate pedestal where such an arrangement is desirable.

The Monroe Calculating Machine

Over the entrance to a New York business house hangs a service flag containing 57 stars. "How are you making up your loss in men?" the manager was asked. "By women and machines," he replied. The Monroe calculating machine does general figuring work—adds, subtracts, divides, and multiplies. One very large concern figured out a saving of 69% in time required to do a certain part of its work. Another considered that at least 15 men would be needed to take over the work of the machines.

This machine will do billing, ledger posting, sales classifications, purchase-ledger, and purchase classification work.

For many years adding or calculating machines have been used in the offices of mining or smelting companies for ordinary routine work. It has long been recognized that they offer far more dependable accuracy and speed than the fastest human calculator could give, but, until recently, these machines did not find favor among men responsible for the technical details of operation, for the reason that they were not sufficiently flexible in scope to include all the intricate calculations which occur in the work of mining and metallurgical engineers. Technical men were on the alert for a machine that would meet their requirements, for they realized that mechanical accuracy and speed are to be preferred to the fastest calculator, with his human tendency to error, or to the most adept user of a slide-rule. When such a machine became finally perfected, it met almost instant approval, and has shown remarkable saving in time and in the intangible but real losses occasioned through some slight error made when the brain was tired or when a guess between the graduations of a slide-rule was a thirty-second of an inch out of the way. The Monroe calculating adding machine was first used as an experiment, but it has now become part of the standard equipment of the Utah Copper, Braden, Chino, Ray Con., Phelps Dodge, American Smelting and Refining, St. Johns, Cerro de Pasco companies and many others.

The uses for the Monroe machine are legion, as it adds, subtracts, multiplies, and divides, with positive action. The American Smelting and Refining Co. uses a Monroe at its Perth Amboy plant, among other purposes, for keeping its stockbook of ore on the dump and for compiling its records of assay and laboratory results. In estimating ore reserves at a mine, an appreciable amount of time is saved with such a calculating machine, and the assurance is gained that the accuracy is positive. The following is an example of a problem calculated by a Monroe machine in 37 seconds:

CALCULATIONS OF AVERAGES FROM WEIGHTED ASSAYS

Width, Feet	Assay, Oz. per Ton	Foot Ounces
7	1.22	8.54
4	0.54	2.16
12	1.20	14.40
8	2.20	17.60
5.3	27.40	145.22
7	1.60	11.20
3.5	0.95	3.32
6	0.39	2.34
6	trace	.....
7.2	trace	.....
66		204.78

Average, $\frac{204.78}{66}$ = 3.1 oz. per ton.

Every engineer knows the amount of time that is wasted in checking up long additions or in repeatedly going over calculations involving decimals carried to the sixth place. Such work is performed on the Monroe machine at remarkable speed. For instance, the following problem in determining arithmetical mean-gross value for three-quarters of a year was calculated in 17 seconds:

	Third Quarter	Second Quarter	First Quarter	Total
Tons milled	523,871	642,683	541,093	1,707,647
Gross value	$1.01	$.112	$1.207	$1.111

$$\frac{(523{,}871 \times 1.01) + (642{,}683 \times 1{,}112) + (541{,}093 \times 1.207)}{1{,}707{,}647} = \$1.111$$

The tables indicate the machine's flexibility.

Events and Economics of the War

Unrelenting pressure by the Allies at all points of the Marne salient has forced the German Crown Prince to retreat in the effort to withdraw his forces from the dangerous pocket; the enemy, while endeavoring to hold his flanks, has been driven north of the Ourcq, leaving Fère-en-Tardenois in the Allies' hands. Three villages near Montdidier were also captured by the French. Elsewhere than on the Western front little action is reported. The White Star liner "Justicia," of 32,120 tons, was sunk by torpedo off the Irish coast, 11 of the crew being lost; the U-boat likewise scored in sinking the British armored cruiser "Marmora" on July 23.

The telegraph and telephone systems throughout the United States were taken over by the Government on July 31 by executive order. In its work upon a revenue bill, the House Ways and Means Committee is said to be in accord with the Senate committee as to excess profits, and to have committed itself definitely to a tax of from 30 to 80% on net incomes, to yield about $1,690,000,000. The Food Administration announced a cut in the household sugar ration to two pounds per person per month, effective from Aug. 1 to the end of the year.

Year's Steel Exports Over Billion Mark

The Government's figures relating to oversea movements of iron and steel in all forms for the 10 months of the year ended with April, 1918, show the total to be $941,400,902. Steel exports for the full year can safely be estimated at around $1,101,500,000, it is claimed, compared with $1,129,341,616 in 1917. The United Kingdom and Canada were the heaviest buyers in many lines, and Japan drew heavily on this country for ship steel. In the 10-month period mentioned, 850,344,047 lb. steel plates was exported; 331,837,297 lb. steel sheets; 353,450 tons steel rails; 28,057,772 lb. railway track material, and 209,389 tons structural iron and steel. Of the steel rails shipped 91,721 tons was for General Pershing's lines and other strictly French requirements. Other details are given in the following table:

MISCELLANEOUS STEEL PRODUCTS EXPORTED IN TEN MONTHS ENDED MAY, 1918

Billets, ingots, and blooms of steel, tons	1,678,620
Wire rods, lb.	376,396,816
All other bars or wire rods of steel, lb.	1,187,540,845
Bar iron, lb.	93,806,796
Galvanized iron and steel sheets, lb.	145,154,908
Iron sheets and plates, lb.	107,247,564
Ship and tank plates, punched and shaped, lb	60,236,835
Shells and empty projectiles	$24,691,134
Tools	$18,924,328
Forgings	$33,217,643
Hoop, band, and scroll products, lb.	114,465,158
Bolts, nuts, rivets and washers, lb.	57,371,189
Horseshoes, lb.	18,519,079
Iron ore, tons	947,134
Wire rope and cables	$3,014,400
Cast-iron pipes and fittings, lb.	145,699,366
Wrought iron pipes, lb.	193,609,331
Nails, cut and wrought, lb.	252,331,373
Machinery, chiefly of iron or steel	$237,976,872
Radiators and house heating boilers, lb.	5,581 259

No exports of pig iron were recorded. Ferromanganese, ferrosilicon and other alloys exported in the 10 months amounted to 331,378 tons. Other exports were 1272 locomotives and 1478 tractor and caterpillar engines.

Chemical Firms Quizzed as to Control

An inquiry into the ownership of three chemical companies to determine whether a transfer of German-owned stock to American interests, made just before the United States entered the war, was *bona fide* has been in progress since July 12. The investigation was begun in New York by the Attorney General at the request of the Alien Property Custodian. The concerns are the Roessler & Hasslacher Chemical Co., New York; the Niagara Electro-Chemical Co., Niagara Falls, and the Perth Amboy Chemical Works, Perth Amboy, N. J., the control of which firms was owned, up to 1916 at least, by the Deutsche Silber und Gold Scheide Anstalt, of Frankfurt-am-Main.

Whether these corporations will pass into the hands of the Alien Property Custodian depends, it is said, on the genuineness of a transfer of the control to American interests made in 1916. It has been shown thus far that despite huge profits the German owners had sold stock in the Roessler & Hasslacher company, which had a book value of $310, for $200 a share, and that the Perth Amboy stock had a book value of $1550 and was sold for $400. Dividends of the Niagara stock in a year were more than double the amount paid for the stock, it was shown. A certain contract proving the real status of the deal is said to be in existence in Switzerland.

War Board Creates New Divisions

The War Industries Board has created two new divisions, to be known as the Chemicals Division and the Explosives Division, it was stated on July 9. Charles H. MacDowell, formerly chief of the Chemicals Section, has been made Director of the Chemicals Division, and M. F. Chase Director of the Explosives Division.

The Chemicals Division will be subdivided into sections to handle the various commodities with which it is concerned. Representatives of the Army, the Navy, the Marine Corps, and other departments have been assigned to each section, and with the commodity chief constitute the sections' membership. In the Explosives Division, Mr. Chase coördinates with representatives of the Army, the Navy, and other departments concerned, and consults with the various section chiefs of the Chemicals Division.

The Business Situation

Business and manufacturing are as near maximum capacity as restricted supplies of raw materials and the difficulty in obtaining adequate labor will permit, according to Pierre Jay, chairman of the board of the Federal Reserve Bank, in a summary of the current trade situation. The two important features in business at this time are the widespread absorption by the Government of industrial products essential for the war and the increase in the scope of the Government's su-

pervision over industry, especially through the control of raw materials.

Under arrangements made on June 6 between the Government and the American Iron and Steel Institute, industries using iron and steel on other than war orders will receive little material. About 85% of the pig-iron output is reported as being necessary for war purposes, although the present rate of production is the highest on record—in May, 3,446,412 gross tons, or 111,175 tons per day.

Traffic on railroads east of the Mississippi is moving smoothly, only 11,000 cars above normal being recorded as in transit on Eastern lines June 14, compared with 160,000 in January, when congestion was acute. April reports for the 34 roads of the Eastern region show increased gross earnings and mileage, net earnings being cut by high operating expenses.

Tax Program Interests Steel Men

"As regards the new taxation program, the steel producers are content to see a high rate imposed upon excess or war profits provided they are allowed a fair exemption in the form of a percentage of capital invested, including the large working capital now necessary, and also a fair deduction from profits for amortization," says the Pittsburgh correspondent of the *Evening Post*. "They lay particular stress upon the last-named item. Construction work has been particularly costly of late, and much of it has been undertaken solely to meet the requirements of the Government. What it will be worth after the war no one knows, but it is regarded as certain it will be worth much less than its cost. Accordingly, a high amortization rate is demanded against all recent new construction.

"Some producers go further and point out that in normal times the industry grows, and new construction takes care of mistakes that may have been made in increasing facilities too rapidly in one direction or another, whereas of late the industry has suffered a forced growth, and will have no occasion to grow after the war, so that this equalization will be denied, and larger depreciation charges should now be made than obtained before the war.

"Thus the administrative details of the prospective tax legislation interest the steel producers more than does the mere percentage rate that may be applied to the greatest profits. In some quarters, indeed, a high rate might be rather welcome, in that it might tend to restrain the War Industries Board from seeking reductions in iron and steel prices. As matters stand, the price schedule must run the gantlet every three months."

British Tungsten Subsidy Proposed

The necessity of manufacturing tungsten powder and ferrotungsten within the British Empire on a scale that will insure an adequate supply for defensive purposes in case of sudden need is pointed out to the British Board of Trade by one of its committees in a recent report. It is also recommended that the works manufacturing tungsten "which have come into existence, either at the request of the government or otherwise during the war, shall receive subsidies or special consideration as regards excess-profits tax in relation to the amount of money they have sunk in the industry, either by way of wolfram ore-dressing plant, tungsten-producing works, research work, mines or concessions for the raising of wolfram ore, and generally with a view to meeting German competition after the war."

The committee also makes the suggestion that engineering manufacturers be encouraged to work together in larger units, either by amalgamation or by joint working, by pooling of resources, by specializing production, and by organization of export sales, and for the purchase of raw materials.

Steel Used for Copper on German Roads

The substitution of steel for important copper parts was alleged by a member of the Reichstag to be the cause of frequent breakdowns of locomotives on German railways, according to an Associated Press dispatch from Amsterdam. The member, Herr Gothein, expressed much concern over the condition of rolling stock on the German roads and asserted that on one out of every five of his railway journeys in the last two years his travel had been interrupted by delays due to the engine breaking down.

Early Shipment of Phosphate Desirable

Those industries requiring the transportation of phosphate rock from the Florida district through the Virginia gateways, so-called, have been urged by the car-service section of the Railroad Administration to pay special attention during the summer months to getting this rock moved and into stock piles, because of the comparatively easy transportation conditions now prevailing. Transportation demands in the autumn and winter, it is intimated, may require restrictive methods. It is suggested that particular emphasis be placed on shipping to points reached via these gateways, as against stocking at points taking the river crossings west of Portsmouth, Ohio, because there will be less freedom of movement through Virginia than through the latter points during the period of heavy traffic.

Oil Trade To Be Regulated

Issuance of a general order regulating the trade practices of oil marketing throughout the country is contemplated by the Fuel Administration. In the case of an oil company at Shreveport, La., which complained of the unfair practices of one of its competitors, it was directed on July 24 that no allowances be made to retailers on gasoline or kerosene exceeding 1c. a gallon and that no drayage allowances should be allowed to consignees on drum or barrel shipments. It also was decided that no permanent equipment could be given or loaned to retailers and that neither premises nor equipment should be bought or rented for them.

Manufacture of turbine engines rated at 700 hp. or over has been placed under Government control, which is to be exercised by the War Industries Board. Only marine types of engines are affected, land types being excepted.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Staff of Bureau of Mines Increased

Irrespective of the passage of the bill for war-minerals control, the U. S. Bureau of Mines expects to concentrate largely on an investigation of war minerals. Work is to be done under the immediate direction of J. E. Spurr, who will also continue as mineral adviser to the U. S. Shipping Board. Mr. Spurr's investigation will cover mining, transportation, ore dressing, smelting and marketing of the war minerals. Special effort has been taken to dovetail this work with that of the Geological Survey on the one hand, and of the War Industries Board on the other.

A corps of men, acting as aides to the executive, has been organized in Washington to keep in touch with all field and experimental work. These comprise two groups, one specializing in mineral commodities and another on mining problems. J. H. Mackenzie, J. E. Maguire, F. W. Paine, H. S. Mudd, A. G. White, Hennen Jennings, H. C. Morris, A. W. Stockett, and Oliver Bowles are included in the former. A large amount of field work covering special war problems is already going on. This is divided into two sections, production and utilization, the latter being carried on largely in the experimental stations of the Bureau.

In studying manganese war problems, H. C. Morris and C. M. Weld are covering the general situation in Washington. Dr. George D. Louderback is in charge of examination work in California, H. M. Parks in Oregon, and C. E. van Barneveld in the Rocky Mountain region. Work is being done on the Cuyuna range, in Minnesota, and W. R. Crane and E. R. Eaton have been engaged in the Appalachians. E. G. Spilsbury and H. W. Hardinge are also making special investigations in the latter region. Bradley Stoughton, H. D. Hibbard, H. M. Howe, J. E. Johnson, Jr., and others are advising concerning the use of manganese in making steel.

Work on chromite is under J. H. Mackenzie and Albert Burch. J. E. Maguire has examined chromite deposits in the East and Earle T. Hill in North Carolina. Chromite deposits in Newfoundland are being investigated by F. H. Probert. R. T. Stull, at Columbus, Ohio, is making a special study of substitutes for chrome brick, in particular of magnesite and dolomite. Promising results have been obtained by the Bureau in concentrating low-grade chrome ores at Seattle, Wash., and Berkeley, California.

Field investigations of graphite are being made by G. D. Dub, loaned to the Bureau of Mines by the New Jersey Zinc Co. R. T. Stull is also making a comparative study at Columbus of domestic flake graphite and Ceylon flake as related to the manufacture of crucibles. F. G. Moses is studying graphite milling processes at the Salt Lake station. H. S. Mudd is in general charge in Washington. The potash problem is being investigated by A. W. Stockett. At Colorado City, in coöperation with the Portland Gold Mining Co., G. H. Clevenger is experimenting on the recovery of potash from the large piles of Cripple Creek tailings. Work on tungsten is in charge of J. H. Mackenzie, assisted by J. H. Means and J. E. Maguire.

The pyrites problem is under the general supervision of H. A. Buehler, with E. A. Holbrook and several assistants assigned to the study of coal pyrites. C. E. Julian has been actively engaged in the South, principally on pyrites. R. R. Hornor has investigated the pyrrhotites of the South and will study methods of mining pyrites in Virginia. L. D. Huntoon has been investigating pyrites in the Northeastern States.

The sulphuric acid situation is under constant review by A. E. Wells, assisted by D. E. Fogg. Iron is in charge of C. M. Weld. H. Foster Bain, assistant director of the Bureau of Mines, with a corps of consulting engineers including Charles Janin, Howland Bancroft, and A. P. Rogers, is covering the tin situation.

To Redraft Minerals-Control Bill

An effort will be made during the recess of Congress by Senator Henderson and other members of the Committee on Mines and Mining to redraft the Minerals-Control bill along lines meeting the approval of the members of the committee. It may be predicted with certainty that the bill which will result will be very different from that which was passed by the House of Representatives.

It had been Senator Henderson's intention to await the reopening of the regular session before attempting the formal drafting of the Senate bill. At the special request of the Secretary of the Interior, however, and with the understanding that the President is much interested, he has consented to work on the bill during the vacation period.

Platinum Licensing Placed in Charge Of Hennen Jennings

Hennen Jennings, one of the U. S. Bureau of Mines' consulting engineers, now doing active work with that organization, will be in direct charge of the licensing of platinum. Though the licenses will be issued by the Bureau, the allocation of platinum will continue under the direction of the War Industries Board. The regulations which will govern the licensing are now being drawn up by a committee consisting of Mr. Jennings, W. F. Hillebrand, of the Bureau of Standards; J. M. Hill, of the Geological Survey; Charles L. Parsons, of the Bureau of Mines, and C. H. Connor, of the War Industries Board.

Substitution of cadmium pigment to replace chrome is being suggested by the War Industries Board. It is stated that it has many advantages over chrome and could be produced in much larger quantities than at present. An important source would be the byproduct of zinc and lead smelting.

July Mining Dividends

Disbursements to stockholders in July, 1918, by 30 United States mining and metallurgical companies making public reports amounted to $5,765,456, compared with $16,531,242 distributed by 46 companies in July, 1917. Of the latter, however, $5,026,450 represented special Red Cross dividends, so that the regular payments were $11,504,792. Canadian, Mexican and Central American companies paid $864,342, as compared with $1,055,807 a year ago.

The interesting features of July were the initial payments by Butte Copper and Zinc Co. and Rochester Mines; also the payment by the Ontario Silver Mining Co., of Utah, which was the first since 1902.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Smelters, pfd. A	U. S.	$1.50	243,846
Am. Smelters, pfd. B	Mex.	1.25	149,885
Arizona Commercial, c	Ariz.	.50	132,500
Bingham Mines, c	Utah	.50	75,000
Butte Cop. & Zinc, mang., z	Mont.	.50	205,850
Caledonia, l.s	Ida.	.03	78,150
Camp Bird, pfd. g	Colo.	.18	110,501
Cresson Cons., g	Colo.	.10	122,000
Daly, l.s	Utah	.10	15,000
Dragon Con., l.s	Utah	.01	18,750
Golden Cycle, g	Colo.	.03	45,000
Homestake, g	S. D.	.50	125,580
Inspiration, c	Ariz.	2.00	2,363,934
Iron Blossom, l.s	Utah	.02½	25,000
Iron Cap, c	Ariz.	.25	36,203
Judge Min. & Smelt., s.l.s	Utah	.12½	60,000
New Idria, q	Calif.	.50	50,000
North Butte, c	Mont.	.25	107,500
Ontario, s	Utah	.50	75,000
Plymouth Cons., g	Calif.	.24	58,520
Portland, g	Colo.	.02	60,000
Rochester Mines, g	Nev.	.02	40,000
Shattuck Arizona, c	Ariz.	.50	175,000
Tonopah Belmont, s	Nev.	.10	150,000
Tonopah Min., s	Nev.	.07½	75,000
Union Con., g	Nev.	.05	10,000
United Eastern, g	Ariz.	.05	68,150
U. S. Smelting, com	U.S.-Mex.	1.25	438,894
U. S. Smelting, pfd	U S.-Mex.	.87½	425,555
Utah Con., c	Utah	.50	150,000
Vindicator, g	Colo.	.03	45,000
Wolverine & Ariz., c	Ariz.	.25	29,638

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Cons. Min. & Sm. Co., c.z	B. C.	.62½	261,936
Howe Sound, c	B. C.	.05	99,208
Lucky Tiger-Comb., g	Mex.	.05	35,767
McKinley-Darragh-Savage, s	Ont.	.03	67,431
N. Y. & Hond. Rosario	C. A.	.50	100,000
Nipissing, s	Ont.	.25	300,000

The totals for the first seven months of the year are as follows: Mining and metallurgical companies, $95,655,043; holding companies, $1,076,866; Canadian, Central American, South American and Mexican companies, $9,755,453.

Back Up the Fighting Men at the Front

Theodore Roosevelt says in a recent article: "There is no American worth calling such whose veins do not thrill with pride when he reads of what has been done by General Pershing and his gallant army in France. The soldiers over there who wear the American uniform have made all good Americans forever their debtors. Now and always afterward we of this country will walk with our heads high because of the men who face death and wounds, and so many of whom have given their lives fighting for this nation and for the great ideals of humanity across the seas.

"But we must not let our pride and our admiration evaporate in mere pride, in mere admiration of what others have done. We must put the whole strength of this nation back of the fighting men at the front. We owe it to them. We owe it at least as much to the gallant Allies who, for nearly four years, fought the great battle that was our battle, no less than theirs."

"Back Up the Fighting Men at the Front," and wherever they are, is not an appeal, but is a command to every American. Back them up here while they are preparing for the front. Give them your support in every way. Our own 27th Regiment is nearest to us. Keep the fund growing. Add what you can to the total.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$13,664.00
Students of Wisconsin Mining School	50.00
A. M. Plumb	5.00
C. W. Snow	2.50
Charles A. Mitke	5.00
A. A. Hassan	10.00
A. A. Hassan, Jr.	5.00
Emin A. Hassan	5.00
Bernard MacDonald	5.00
C. F. Rand	50.00
Calumet & Arizona Mining Co. and New Cornelia Copper Co.	400.00
Oscar Lachmund (fourth contribution)	20.00
C. N. Bell	10.00
C. S. Witherell	25.00
W. G. McBride	25.00
Karl Eilers	50.00
R. T. Hancock	5.00
E. E. White	100.00
S. Ringlund	10.00
H. Foster Bain	10.00
Marc Bailey	10.00
Charles Le Vasseur (second contribution)	10.00
William Wraith	25.00
H. A. Wheeler	10.00
Nevada Mine Operators' Association	100.00
Louis R. Wallace	50.00
H. P. Bowen	5.00
H. L. Brown and M. W. Hayward	16.00
Iron Cap Copper Co.	50.00
W. N. Smith	10.00
E. S. Geary	5.00
H. J. Wolf	10.00
F. H. Siebold	10.00
H. A. Kee	10.00
W. S. Grether	5.00
Marion J. Thomas	10.00
E. F. Eurich	10.00
Liberty Bell Gold Mining Co.	200.00
H. De Witt Smith	15.00
Associated Miners of the University of Idaho	10.00
New Idria Quicksilver Mining Co.	100.00
F. P. Burrall	25.00
Livingston Wernecke	5.00
E. P. Mathewson	50.00
Interest to June 26	82.61
H. W. Hixon	10.00
R. C. Canby	10.00
S. R. Guggenheim	100.00
Richard Tavis	5.00
Simon Guggenheim	100.00
J. V. Kelley	10.00
Algernon Del Mar	4.00
Sumner S. Smith	5.00
Will H. Coghill	10.00
Lincoln Crocker	10.00
C. E. Dewey	10.00
Plymouth Consolidated Gold Mines, Ltd.	100.00
United Eastern Mining Co.	50.00
W. A. Wilson	20.00
Oscar Lachmund	10.00
W. Rowland Cox	10.00
L. D. Huntoon	5.00
Alaska Mining and Engineering Society	50.00
W. R. Benedict	3.00
Etheredge Walker	25.00
Fritz Mella	10.00
Richard McCarthy	10.00
J. N. Houser	10.00
Total	$15,867.11

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Owing to the large volume of work involved in administering the fund, contributions are acknowledged only by publication in the *Journal*.

Red Tape Cut in Steel Shipments

WASHINGTON CORRESPONDENCE

By permitting shipments of iron and steel products, not in excess of five tons, without a priority order, the War Industries Board has taken a step which is expected to prevent a great deal of inconvenience to many industries. Incidentally the board will be relieved of a large volume of work required in handling small orders. As the mining industry uses a large amount of steel in quantities of less than five tons, it will benefit considerably, it is thought, from the order. Mining tools, tin-plate and oil-well supplies come within the purview of the order.

Standardization of Wages Next

WASHINGTON CORRESPONDENCE

In discussing the standardization of wages throughout the nation, Felix Frankfurter, chairman of the War Labor Policies Board, says:

Congress, through the taxes on excess profits; the War Industries Board, through its price-fixing; the President, through the veto of $2.40 wheat, have prepared the way for standardization of wages. Additional methods of keeping down the cost of living are being investigated at this time.

All these measures, past and pending, have revealed the determination of the American people to let no one make money out of the war. What price-fixing means for the manufacturer, wage standardization is to the workers of the country.

That means plainly that just as the price-fixing committee takes into account the cost of production and proper profits, so wage standardization must be built upon an accurate knowledge of the cost of living and a just estimate of what makes up the right American standard.

Upon these general grounds, the War Labor Policies Board is advancing, as rapidly as the gravity of the problem permits, to the establishment of standard wages. Every one who has a real interest at stake will be consulted.

American Zinc Institute Meets At St. Louis

Successful beyond expectation was the meeting of the American Zinc Institute at the Statler Hotel, St. Louis, Mo., on July 29 and 30. Approximately 180 persons interested in mining, smelting and consumption of zinc attended, all sections of the United States being represented.

Permanent organization of the Institute will be carried out under plans to be worked out by a committee of seven, two of whom represent mining interests exclusively, two smelting interests exclusively, and three combined mining and smelting interests. Victor Rakowsky, of Joplin, and J. L. Bruce, of Butte, are the mining members; E. H. Wolff, of Peru, Ill., and A. B. McMillan, of St. Louis, the smelting representatives; and C. T. Orr, of Webb City, Mo., A. P. Cobb, of New York, and W. F. Rossman represent the mining and smelting interests combined.

This organization committee was named by a committee of 21 members, selected on Monday by Victor Rakowsky, C. E. Siebenthal and W. R. Ingalls, and will report by mail to the members of the Institute within 90 days. The committee of 21 is thoroughly representative of all branches of the industry and all parts of the United States.

The keynote of the meeting was coördination and coöperation of all branches of the zinc industry. This note was sounded by Mr. Ingalls in an address on the first day, and met with full endorsement from the delegates. The convention was unique in that the program as previously outlined was carried out in its entirety, no one of the speakers being absent. Features of Tuesday's meeting were addresses by A. P. Cobb on "New Uses of Zinc"; by E. H. Wolff on "Benefits of Coöperation Between Mining and Smelting Interests"; and by Dr. John Johnson on "Value of Experimental Work in Developing New Uses of Zinc and Zinc Products." Mr. Cobb stated that zinc can be made to take the place of other metals in countless cases. He referred to the uses of zinc in Europe for roofing and in freight cars and in other ways, and spoke of the possibility of making zinc replace copper, tin and other metals in the manufacture of many small articles. He also called attention to the fact that the New Jersey Zinc Co. is now erecting in New York a building for its use, in which all the metal work, except plumbing, will be of zinc.

Mr. Wolff said that one work of the Institute should be the formation of an export and import committee to consider the problem of securing a tariff on zinc products following the war. He said that just before the opening of the war, Germany and Belgium were becoming serious competitors of American sheet zinc makers by virtue of the tariff law of 1913.

Following a banquet on Monday night, at which addresses were made by C. T. Orr, Private Drew, of the Canadian forces, George E. Nicholson and several others, pledges for the expenses of the preliminary organization work of the Institute were asked for and about $1000 in excess of the sum named was subscribed. It was voted to contribute this surplus to the 27th Engineers' Comfort Fund, being raised by the *Engineering and Mining Journal*. The opinion of the mining and smelting representatives, expressed at the close of the meeting, was that a foundation has been laid for permanent betterment of the zinc industry in the United States.

War Minerals Corporation Favored By Senator Henderson

WASHINGTON CORRESPONDENCE

After a conference with President Wilson and a thorough discussion of the matter with Secretary Lane, as well as with Bernard M. Baruch, chairman of the War Industries Board, Senator Henderson, of Nevada, chairman of the Committee on Mines and Mining, will suggest to his committee that the War Minerals Bill be amended so as to place full powers for handling war minerals in the hands of the President, with the specific authorization that he may form a corporation to carry out the intent of the bill. Since Senator Henderson is being looked to by the members of the committee to take the initiative in this legislation, it is probable that his conclusions will be supported.

Senator Henderson considers that the $10,000,000 appropriation, which is carried by the bill passed by the House, is insufficient to carry out the purposes of the measure, and he will urge that $50,000,000, at least, be used as a revolving fund. The Senate, it is thought, will not go into the matter of maximum or minimum prices. The new bill will probably be much more general in its provisions than was the House bill. All details as to administration will be left to the discretion of the President.

Senator Henderson is denying himself a vacation and expects to have a draft of the proposed Senate bill ready to submit to the committee within two weeks. The committee will have the bill in final shape in time to lay it before the Senate immediately following the recess.

No formal consideration has been given as yet by the House Committee on Ways and Means to the things that specifically affect gold and other metal mining and the handling of platinum. It is probable that these matters will be deferred until the more general provisions of the bill have been agreed upon.

Editorials

Price-Fixing

THE subject of price-fixing, both in the phases of what has and what has not been done and in the effects, is too complicated for any economist yet to offer the results of a thorough study. But there are at least two incontrovertible deductions:

1. If there be fixed a maximum price, and if the market price remains at that figure, there is not enough of the commodity.

2. If a maximum price be fixed at a point above a free market price, the latter will fluctuate normally beneath it, but investment in new plant for the increase of production is likely to be deterred, wherefore there may eventually result the economic drawback of a maximum price that is directly restrictive.

There are probably many other theories to be deducted from the dangerous fallacy of price-fixing, but they will await more exhaustive study of cause and effect.

The Federal Trade Commission, which has been one of the exponents of price-fixing, sent to the Senate on June 29 a report on the existence of profiteering among American industries at the present time, which describes it in part as being due to "inordinate greed and barefaced fraud." Price-fixing, the report says, has tended to prevent run-away markets, but at the same time it strengthens the stronger factors in industries in their position and enriches them by profits "which are without precedent."

Clearly the only way that price-fixing can strengthen the stronger factors is by driving the weaker out of business and giving more of the market to the stronger; in other words, by being restrictive of production.

The Federal Trade Commission not only finds it difficult to maintain its equilibrium in walking that tight rope, but loses its balance completely on another one when it argues that the operation of the law of supply and demand is responsible for the large profits in the petroleum industry, that "industry being one where the law of supply and demand still operates."

The Federal Trade Commission, like King Canute, who commanded the tide to cease rising, feels that it has told the law of supply and demand that it is abolished, and therefore it ought not to operate anywhere. Incidentally, its minds have failed to react to the facts that the petroleum industry, which is one that has escaped price-fixing, is also that one of our great major industries whose products are in easiest supply and at no great advance in price.

The Federal Trade Commission was more responsible than any other agency for the trouble in our coal business last summer, which culminated in the disaster of last winter. That put it under such a cloud that it has been out of sight of late, but it was to be expected to bob up again serenely some day. Given a free hand, it can cause us to lose the war with its vagaries. The real place for the luminaries of this organization is at the elbow of Mr. Lenine and Mr. Trotzky.

The law of supply and demand has not been abolished any more than the laws of gravitation, of conservation of energy and the movements of the solar bodies. By the expenditure of energy an aëroplane can mount into the clouds, but the aviator knows well that the law of gravitation is not abrogated. In spite of price-fixing, the law of supply and demand has been working inexorably, vain and deluded persons to the contrary notwithstanding.

Mr. Hoover, who is a hundred times more intelligent than most of the leaders by whom he is surrounded in Washington, has leaned toward price-fixing as a matter of policy, but we are not sure that he is not somewhat confused on the subject, and certainly he has not violated the law in the way that the War Industries Board has done. In a recent address to some professional colleagues Mr. Hoover said frankly that economists of the old school were adverse to price-fixing, but he thought that we should recognize the new conditions of concentrated buying, something that never previously existed; and also should recognize that the classic argument of high prices being the surest and quickest way of curtailing consumption would be in favor of the rich and against the poor, a condition not to be tolerated.

The factors that are introduced by concentrated buying do not produce any violation of economic law, nor are they a novelty resulting from the war, except with respect to their enormous scale. A producing and selling monopoly is just as much subject to the law of supply and demand as is anybody else, as Professor Taussig will testify unless he has modified the ideas expressed in his "Principles of Economics." A buying monopoly meets the same principles from the opposite direction. Concentrated buying is admittedly of great influence upon a market, just as Mr. Hoover, with his great commercial experience, has demonstrated; but that is no new discovery. For example, the concentrated buying by the U. S. Steel Corporation long before the war had a dominating influence upon the American zinc market. It is conceivable that the business in a commodity might be confined to two parties—one producer and one consumer. Indeed, we have something of that sort now in the cases of aluminum and nickel. Prices are arranged by agreement between the two parties, but the law of supply and demand obtains just the same. The evil of Governmental price-fixing is that it is not a matter of agreement, or, if so, there is a good deal of fiction about the "agreement." Thus, the coal producers and departments of the Government *agreed* about a year ago upon a price for coal. Other departments of the Government repudiated that agreement and *fixed* a scale of prices much lower. We need not rehearse what ensued, but we may quote R. V. Norris, of the Fuel Administration, who, at the same recent meeting at which Mr. Hoover spoke, said bluntly that the Fuel

Administration had made a mistake; that it had been compelled to raise its fixed prices to within a few cents per ton below the figures of the Lane-Peabody agreement, and that the increased statistical production of coal in 1917 had, indeed, been increased production of slate. Mr. Manning, of the U. S. Bureau of Mines, was one of the first to make the last assertion. Let it be noted that we are not now quoting unofficial criticism, but rather that of bureaus of the Government itself.

With respect to Mr. Hoover's second point, questions of politics become involved with those of economics. We have been ready to admit that in the matter of food supply—something that the people must have in equal distribution—a rejection of the principles of *laissez faire* is defensible. An elimination of the intermediate speculation between the harvests, which Mr. Hoover has so skilfully managed, is distinctly economic and in no way in violation of natural law. But whether control or high prices would be most effective in curtailing consumption, and what would be the political reactions, are not so clear. There is considerable evidence that under the plan that has been adopted it is the rich who are thrifty and the poor who are extravagant. When the natural control over extravagance by high prices disappears, it becomes necessary to introduce ration-card systems. But even so, and with all the Governmental administration, both here and abroad, the natural law is determining conditions just as if there were no war. In Europe the price of bread is kept low by Governmental subsidies, but the governments themselves must pay for wheat the price that is necessary to get it.

We are beginning to unveil the complexities of the whole subject. There are certain differences in conditions of commodities that directly touch the necessities of the people, and those that do not; between those that are of seasonal production and those that are not, but in the long run the same law rules. Three years ago people would risk their money in building new plants. Now they will not. The Government has to supply the money or else supply a guarantee. Price-fixing may seem to save money in one way, but it costs more in another. We do not think that Mr. Hoover is such a repudiator of natural laws as sometimes he says he is. Anyhow, there is a wide difference between Mr. Hoover's practices in price-fixing and those of some other agencies in Washington.

Washington Quietly Reverses Itself

MANY months ago we used to be flooded with announcements of dictatorial actions by bureaus and boards in Washington. The War Industries Board, the War Trade Board, and every board, big and little, delighted in telling the people what they were to do on and after a certain date. The consumption of paper was enormous. Protests against actions announced, representations respecting their impracticability, and forecasts of difficulties to ensue all went unheeded. The board ordered, and so it was to be. Apparently the several boards thought that they were gifted with omniscience. Many humble persons thought otherwise. However, it took time for the boards to learn, but, given time enough, things were bound to creep into the minds of even the most blockheaded. It is noteworthy, however, that the reversals are not heralded by the press bulletins in the way that the orders used to be.

Washington was told at the very beginning of the war that it was a bad plan to draft miners. England had learned that by painful experience, but Washington disregarded both the experience and the warnings. It took time and the waning production of coal and the metals to get this into official heads.

Not long ago the War Trade Board was going to do spectacular things in the way of restricting exports in what it academically classed as non-essentials. However, the South American and other countries that wanted goods did not agree with our definitions about what was non-essential; and inasmuch as we needed things from those countries and had to pay for them by the exchange of either goods or gold, the occasion arose for a quiet reversal of policy.

So, too, with the War Industries Board. It was confident that it could suspend the law of supply and demand and dictate prices forever and a day, but after perpetrating much mischief it also is beginning to see things, and is raising prices, from time to time, though always too late.

The Federal Trade Commission still tries to stick crowbars through the spokes of production, but Dr. Garfield apparently does not think very much of the Federal Trade Commission. About a year ago it handed him a bomb, without telling him about it, and he innocently dropped it and caused an explosion that brought objurgations upon him. Nowadays, Dr. Garfield, who has developed a pretty good kind of an administration, does his own figuring respecting the cost of producing coal, and seems to be contemptuous of the Federal Trade Commission. Other people feel the same way toward it.

Well, the world does move, the members of bureaus and boards do learn by experience; but what a pity it is that the experience must be so dearly bought, simply for the sake of refusing expert advice.

The Government has taken over the telegraphs and telephones, which have been put in charge of Mr. Burleson. He tells the people, through interviews with the press, of the wonderful things that he is going to do in the way of reducing charges, improving services, etc. We should feel more assurance as to these optimistic promises if the postal service had been distinctly improved; whereas, on the contrary, it is well known to have deteriorated. We should think that the Post Office people would have some pride in being efficient, but they seem to be uninterested in their work and callous to complaints. We must confess to feelings of alarm about what is going to happen to the wire services. Is the time coming when we cannot be sure of the delivery of our messages to Washington and Boston inside of a day or two?

We have previously remarked upon how mining engineers are the men to do things, and have mentioned Hoover and others as shining examples. The State of Nevada did a good thing for itself when it elected one of the profession—Emmet H. D. Boyle—to be its Governor. Governor Boyle made a very fine impression upon everybody when he visited New York and Washington last winter. Governor Boyle did a good job when he appointed Charles B. Henderson to the Senate to succeed

the late Mr. Newlands. Senator Henderson, as chairman of the Committee on Mines and Mining, has exhibited himself as an earnest, intelligent and hard-working legislator, who is sympathetic with the mining industry and is raising his committee to the importance that is its due as the representative of one of the great basic industries of the nation.

BY THE WAY

Jack: Howld tha jaw, Sampey. I doan't want ee prachen to me; aal tha same, bleve thare's truth en what thee's say. I doan't fess to be a Christian, but aal tha saame I bleve they who do liv too et hav tha best ov the argement. But how caan a feller be a Christian in a minin' taown like Broken 'Ill, weth all tha sin and cussedness by which ee be surrounded? In tha street ee can see sin in various forms, like ee can in biggar cities, and ef ee go to hes union metins, I tell ee, et es very diffurunt to a Methody praier metin; what wuth the hosifers cussing each other, and sumtimes members axing questuns tha hosifers doan't like, and espechully if they should ax any question about the strike funds—or the funds to relieve tha unemployed, oh! my Jemima! look out fur scwa's and storm, and a pre-emptory shut up. I tell ee, no dacent members of the unions care to cum to the metins, and so them les fitted fur the poshesuns and caan make moast noise get the sates of the hosifers, and doan't they show what they be maade of!

Sampey: Howld tha durnd tongue, taalking about tha unions. I doan't want any moar of they. Tha strike of larst year and tha way things was carried on satisfied me that unionism is a good thing fur a few, but a confounded costly thing fur tha many; and how we hav been such fools to stan et so long es what I caan't tell ee. Here the managers of the unions got the money, and they waen't pay out any ov et to the like of me, who haave been idle moast of tha time sense tha strike commenced laast year, and our state is very pitible, I sure ee; but they doan't care. It look to me like ef they want to keep et fur themselves, or to bolster up tha traading consarns they hav got on thare hands. Can you tell me, Jackey, who has got the benefit ov thoose consarns—the union members or the top sawyers in the consarns? Have they employed more men to do the wurk? Do they sell cheaper or what es the advantage gained to the working man? I fail to see et. Et may be because I am dense, and do not see so fur ahead as the clever labour leaders; but, take ut frum me, no more strikes fur me, thank ee.—"One and All," in *Barrier Miner*, N. S. W.

The disagreement of authorities, coupled with a prolixity in individual interpretation, is not a new feature in mining and geological endeavor. A gentleman who wrote of these matters in 1683 in a book dealing with "The Laws of Art and Nature in Knowing, Judging, Assaying, Fining, Refining, and Inlarging the bodies of confined metals," speaks, in the preface, of "the Rise and Springs of metallic oars, and how they grow in the Mountains, Veins, and Channels of the Earth, and how generated (of which the old and later Philosophers had many different opinions) as also the Streams, Channels, and their Enternals (and other accidents which do discover and produce oars whereby the miners do guid themselves in their proceedings and works) yet because it would be too long to recite those *Opinions of Philosophers* and various Operations of miners (in respect they do now agree in all things, and miss very much of their aims, and have written many books to little purpose) therefore, for brevity sake, I have omitted them, and proposed only my own practice for the better advancing this Metallick Art." The original treatise was written in German by one Lazarus Erckern, who was "Chief Prover (or Assay Master General of the Empire of Germany)," and the quaint way in which he brushes aside the "Opinions of Philosophers" to make room for a recital of his "own practice" indicates that the Teutonic sense of humor, as we understand it today, is also not a recent acquisition.

Metallurgists who are looking for knotty problems will probably hail with delight the recent discovery of a complex ore reported in a New York paper: "According to consular reports, residents of Puerto Cortes, Honduras, have discovered a deposit of manganese within two miles of the line of the national railroad. It is stated that the ore is mixed with graphite, copper and gold."

A Twentieth Century Paul Revere

Listen, my children, and you shall hear
Of another rider than Paul Revere;
Of a tiny lad on a strange, strange steed,
Who rode a race for his country's need.

He heard of his country's call for men;
He heard of their sacrifice, and then—
He heard of the need for money, too;
For food and clothes to help them through.

He wanted to help, though he could not fight;
He wanted to serve in the cause of right.
So he mounted a Thrift Card, reins in hand,
And rode and rode throughout the land.

"Money!" he cried. "Money for clothes,
The boys in the trenches"—off he goes;
And amid the sound of clattering hoofs
The call reëchoed across the roofs—

"Gather your nickels, gather your dimes,
Help the nation, prepare, these times."
The people heard, as the boy flashed by;
They heard his fevered, earnest cry.

And out of the stockings laid away,
And out of the closet hid from day,
They gathered their savings of many years,
And poured them forth with many cheers.

"Take these," they cried, "In the cause of right,
We'll save for the boys who nobly fight."
As on he sped he heard them say,
"We'll do our bit—save every day."

And when the boy on his valiant steed,
Had spread the news of his country's need,
He drew the reins on the old "Thrift Stamp,"
And petted his nose, all sweaty and damp;

"Our work is done," he said, "Old Man,
The nation's roused to the War Thrift Plan."

—*Unknown.*

Today is an opportune time to send a check for the Comfort Fund of the 27th Engineers.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittance are made in even dollars, we will return the excess over an order in coupons if so requested.

COPPER

9588—ANALYSIS—Determining Copper Minerals in Partly Oxidized Ores. Felix Cremer. (Met. and Chem. Eng., June 15, 1918; 2½ pp.)

9589—CUBA—Reseña histórica sobre la minería en Oriente, Cuba. (Bol. de Minas, Havana, Cuba, Jan., 1918; 36 pp., illus.)

9590—FIRE—Engineering Problems Encountered During Recent Mine Fire at Utah-Apex Mine, Bingham Canyon, Utah. V. S. Rood and J. A. Norden. (Bull. 138, A.I.M.E., June, 1918; 11 pp., illus.)

9591—FLOTATION—La Concentracion de los Sulfuros Minerales por la Flotacion. (Bol. des Minas, Havana, Cuba, Jan., 1918; 5½ pp.) Data on work at El Cobre plant.

9592—MEXICO—La Mina "El Tigre." Marcelo Pena. (Bol. Minero, Feb., 1918; 6½ pp., illus.)

9593—PRODUCTION of Copper in the United States in 1917. B. S. Butler. (Advance copy, U. S. Geol. Surv., 1918; 6 pp., illus.)

9594—REFINERY—Construction and Operation of an Electrolytic Copper Refinery. J. E. McAllister. (Canada Munition Resources Commission, Nov., 1915, to Feb., 1918; 11 pp., illus.)

9595—REFINING—The Maintenance of High Ampere Efficiency in Electrolytic Copper Refining. M. H. Merriss and M. A. Mosher. (Eng. and Min. Journ., July 20, 1918; 4 pp., illus.) 20c.

9596—SMELTING—Blast-Furnace Plant for Smelting Copper Ore. Forest Rutherford. (Eng. and Min. Journ., July 20, 1918; 2 pp., illus.) 20c.

9597—SMELTING—Coal-Dust-Fired Reverberatory Furnaces in Chile. (Eng. and Min. Journ., July 6, 1918; ½ p.) 20c.

9598—SMELTING—Experiments in Fettling Reverberatory Furnaces. Forest Rutherford. (Eng. and Min. Journ., July 20, 1918; ⅔ p.) 20c.

9599—SMELTING—Improvements at the Consolidated Arizona Smelting Co.'s Plant. Frank R. Corwin. (Eng. and Min. Journ., July 20, 1918; 1 p., illus.) 20c.

GOLD AND SILVER—GEOLOGY

9600—AUSTRALIA—The Factors Influencing Gold Deposition in the Bendigo Goldfield. F. L. Stillwell. (Bull. 4, Advisory Council of Science and Industry, Melbourne, Aus., 1917; 68 pp., illus.) Report of a special committee appointed to investigate the mode of occurrence of gold in quartz in Australia, with a view to determining the principles which have led to the localization of payable gold, and thus, among other things, cheapen the cost of deep prospecting.

9601—CHOSEN—Geology and Ore Deposits of the Collbran Contact of the Suan Mining Concession, Chosen. D. F. Higgins. (Econ. Geol., Jan., 1918; 34 pp., illus.) 60c.

9602—ONTARIO—Matachewan Gold Area. A. G. Burrows. (Bull. 34, Ont. Bureau of Mines, 1918; 30 pp., illus.)

9603—YUKON TERRITORY—Frozen Muck in the Klondike District, Yukon Territory, Canada. J. B. Tyrrell. (Paper before Royal Soc. of Canada, May, 1917; 10 pp., illus.)

GOLD AND SILVER—CYANIDING

9604—CYANIDE AND ZINC CONSUMPTION, A Method for Further Reducing. R. C. H. Cooke. (Journ. Chem., Met. and Min. Soc. of So. Afr., Aug., 1917; 3½ pp.) 60c.

9605—PRECIPITATION—Charcoal Precipitation of Aurocyanide. A. W. Allen. (Met. and Chem. Eng., June 15, 1918; 2 pp., illus.) Description of the new Moore-Edmands process with discussion of the underlying theories.

9606—SEPARATION (AUTOMATIC) OF SOLUTION FROM SOLIDS in the Hydrometallurgical Treatment of Ore Pulps. Bernard MacDonald. (Bull. A.I.M.E., July, 1918; 4 pp., illus.) 40c.

9607—WEST AFRICA—Data on Crushing and Cyaniding in a West African Mill. Paul T. Bruhl. (Eng. and Min. Journ., July 13, 1918; 3 pp., illus.) 20c.

GOLD AND SILVER—GENERAL

9608—BRITISH COLUMBIA—Salmon River, Portland Canal. B. C. (Min. and Eng. Rec., Apr. 30, 1918; 5 pp., illus.) 20c.

9609—SANDFILLING—Further Notes on Sandfilling of Mines. C. H. Greathead. (Journ. Chem., Met. and Min. Soc. of So. Afr., Apr., 1918; 3½ pp., illus.) Deals with some minor alterations that have been introduced in the practice at the Simmer & Jack mines, and development of methods for reclaiming pillars. 60c.

9610—SMELTERY—Ideal Layout for Silver-Lead Smeltery. Guy C. Riddell. (Eng. and Min. Journ., July 20, 1918; 7½ pp., illus.) 20c.

9611—SURVEY OFFICE on the Rand. E. M. Weston. (Eng. and Min. Journ., July 13, 1918; 3½ pp.) 20c.

9612—WESTERN AUSTRALIA—Gold Mining in Western Australia. The Present Position and Outlook of the Kalgoorlie Mines. Thomas Butement. (Chem. Eng. and Min. Rev., June 5, 1918; 5 pp., illus.; to be continued.) 40c.

IRON ORE DEPOSITS, MINING, ETC.

9613—CUBA—Reseña histórica sobre la minería en Oriente, Cuba. (Bol. de Minas, Havana, Cuba, Jan., 1918; 36 pp., illus.)

9614—MINNESOTA—Some Features of Magnetic Surveys of the Magnetite Deposits of the Duluth Gabbro. T. M. Broderick. (Econ. Geol., Jan., 1918; 14 pp., illus.) 60c.

9615—SHAFT RELINING—Notes on Shaft Relining With Concrete. G. G. Stonemark. (Eng. and Min. Journ., July 6, 1918; 3 pp.) Refers to Shafts "A" and "C" at the Tener Mine, Chisholm, Minn.

9616—SPAIN—Iron and Coal in Spain After the War. (Iron and Coal Tr. Rev., Feb. 8, 1918; 1 p.) Data from a pamphlet by Señor Don Julio de Lazurtegui. 40c.

9617—UNITED KINGDOM—The Jurassic Ironstones of the United Kingdom Economically Considered. F. H. Hatch. (Iron and Coal Tr. Rev., May 10 and 17, 1918; 5½ pp., illus.) 40c.

IRON AND STEEL—METALLURGY

9618—BLAST-FURNACE PLANT—Modern German Blast-Furnace Plant. (Iron and Coal Tr. Rev., June 21, 1918; 2 pp., illus.) From a description in recent issues of "Stahl u. Eisen." 40c.

9619—BLAST FURNACES—Fuel Economy in Blast Furnaces. T. C. Hutchinson. (Iron and Coal Tr. Rev., May 3, 1918; 1⅞ pp., illus.) Paper read before the Iron and Steel Inst.

9620—CARBON IN STEEL—Rapid Determination of Carbon in Steel by the Barium Carbonate Titration Method. J. R. Cain and L. C. Maxwell. (Journ. Ind. and Eng. Chem., July 1, 1918; 2½ pp.)

9621—ELECTRIC FURNACE—The Booth-Hall Electric Furnace. W. K. Booth. (Advance copy, Am. Electrochem. Soc., May, 1918; 10½ pp., illus.) 40c.

9622—ELECTRIC STEEL—Triplex Process of Making Electric Steel. Development at South Chicago of the World's Largest Electric Steel Plant, Comprising Three 25-Ton Heroult Furnaces. Theodore W. Robinson. (Chem. and Met. Eng., July 1, 1918; 5½ pp., illus.) Excerpt of paper before Am. Iron and Steel Inst., May 31, 1918.

9623—REFRACTORIES—Essential Properties of Refractories Used in Steel Production. Alleyne Reynolds. (Iron and Coal Tr. Rev., May 24, 1918; ⅝ p.) 40c.

9624—SULPHUR IN IRON AND STEEL—A Standard Apparatus for the Determination of Sulphur in Iron and Steel by the Evolution Method. H. B. Pulsifer. (Journ. Ind. and Eng. Chem., July 1, 1918; 4⅔ pp., illus.) 60c.

LEAD AND ZINC

9625—BUNKER HILL & SULLIVAN SMELTING AND REFINING PLANT—Use of Pulverized Coal at the Bunker Hill & Sullivan Smelting and Refining Plant. C. T. Rice. (Eng. and Min. Journ., July 20, 1918, 3½ pp., illus.) 20c.

9626—RESEARCH PREPAREDNESS in the Zinc Industry. Parker C. Choate. (Chem. and Met. Eng., July 1, 1918; 2½ pp.)

9627—ROASTING ZINC SULPHIDE ORES, Notes on a New Method of. Gilbert Rigg. (Min. Mag., June, 1918; 2¾ pp.) 60c.

9628—SMELTERY—Ideal Layout for Silver-Lead Smeltery. Guy C. Riddell. (Eng. and Min. Journ., July 20, 1918; 7½ pp., illus.) 20c.

9629—SMELTING—Mechanical Scotch-Hearth Smelting. Wm. E. Newnam. (Eng. and Min. Journ., July 20, 1918; 3½ pp., illus.) 20c.

9630—ZINC OXIDE—Baghouses for Zinc Oxide. John F. Cregan. (Eng. and Min. Journ., July 20, 1918; 7 pp., illus.) 20c.

OTHER METALS

9631—ALUMINUM—Bauxite and Aluminum in 1917. James M. Hill. (Mineral Resources of the U. S., 1917—Part I, 9 pp.)

9632—ARSENIC, Bismuth, Selenium and Tellurium in 1917. Joseph B. Umpleby. (Mineral Resources of the U. S., 1917—Part I, June 19, 1918; 13 pp.)

9633—CADMIUM in 1917. C. E. Siebenthal. (Mineral Resources of the U. S., 1917—Part I, July 12, 1918; 5 pp.)

9634—MANGANESE Conservation in Steel Making. C. R. Ellicott. (Iron Tr. Rev., June 6 and 13, 1918; 5 pp.) Paper presented at meeting of Am. Iron and Steel Inst., May 31, 1918; with discussion by G. B. Waterhouse and J. W. Richards.

9635—MANGANESE—Reseña histórica sobre la minería en Oriente, Cuba. (Bol. de Minas, Havana, Cuba, Jan., 1918; 36 pp., illus.)

9636—MANGANESE—Some Manganese Deposits in Madison County, Montana. J. T. Pardee. (Bull. 690-F, U. S. Geol. Surv., July 8, 1918; 13 pp.)

9637—MANGANESE—The Las Vegas Manganese Mine. (Min. and Oil Bull., June, 1918; 1½ pp., illus.)

9638—PLATINUM RICHES of Russia. (Russia, June, 1918; 6 pp., illus.) Data on production, distribution of deposits, etc., illustrated by maps. 20c.

9639—QUICKSILVER DEPOSITS of the Phoenix Mountains, Arizona. F. C. Schrader. (U. S. Geol. Surv., Bull. 690-D, 1918; 14 pp., illus.)

9640—TIN—Determination of Tin in Concentrates. A. M. Smoot. (Eng. and Min. Journ., July 6, 1918; 2 pp., illus.) 20c.

9641—TIN—El Mercado de Estano. Guillermo Yunge. (Bol. Soc. Nac. de Mineria, Nov.-Dec., 1917; 5 pp.)

9642—TIN—Electrolytic Refining of Tin. Edward F. Kern. (Advance copy, Am. Electrochem. Soc., May, 1918; 12 pp.)

9643—TIN—Neill Jig Tests for Tin Dredging. L. H. Eddy. (Eng. and Min. Journ., July 13, 1918; 1 p.) 20c.

9644—TUNGSTEN—The Metallography of Tungsten. Zay Jeffries. (Bull. 138, A.I.M.E., June, 1918; 56 pp., illus.)

9645—TUNGSTEN—The Mineral Industry of Portugal. Frederick W. Foote and Rastus S. Ransom, Jr. (Eng. and Min. Journ., July 13, 1918; 6¼ pp., illus.) 20c.

9646—TUNGSTEN PRODUCERS TARIFF BOARD HEARING at San Francisco. (Eng. and Min. Journ., July 13, 1918; 1½ pp.) 20c.

9647—URANIUM-VANADIUM ORES, Some Chemical Experiments Bearing on the Origin of. Frank B. Notestein. (Econ. Geol., Jan., 1918; 14 pp.) 60c.

9648—ZIRCONIA as a Refractory. E. H. Rodd. (Journ. Soc. of Chem. Ind., June 15, 1918; 2 pp.)

NONMETALLIC MINERALS

9649—BARITE DEPOSITS of the Sweetwater District, East Tennessee. C. H. Gordon. (Resources of Tenn., Jan., 1918; 35 pp., illus., including map.)

9650—BAUXITE and Aluminum in 1917. James M. Hill. (Mineral Resources of the U. S., 1917—Part I; 9 pp.)

9651—GEMS and Precious Stones in 1916. Waldemar T. Schaller. (Mineral Resources of the U. S., 1916—Part II, June 27, 1918; 13 pp.)

9652—GRAPHITE—Grafitos de la provincia de Huelva. A. Carbonell Trillo-Figueroa. (Revista Minera, May 1, 1918; 2½ pp.) 40c.

9653—GRAVEL DEPOSITS of the Caddo Gap and De Queen Quadrangles, Arkansas. Hugh D. Miser and A. H. Purdue. (Bull. 690-B, U. S. Geol. Surv., June 14, 1918; 15 pp., illus.)

9654—MICA—Report on Certain Minerals Used in the Arts and Industries—IV. Percy A. Wagner. (So. Afr. Journ. of Ind., Apr., 1918; 15 pp., illus.)

9655—POTASH, Occurrence, Uses, Recovery, Demand and Prices, Tests and References. W. F. Coolbaugh. (Colo. School of Mines Mag., Vol. VIII, June, 1918; 2½ pp.)

9656—SALT—The Theory of Volcanic Origin of Salt Domes. E. Degolyer. (Bull. 137, A.I.M.E., May, 1918; 14 pp.)

9657—SILICA PRODUCTS—Raw Materials. A. Bigot. (Iron and Coal Tr. Rev., May 17, 1918; ¾ p.) Translated from the French by J. A. Audley. 40c.

9658—STRONTIUM in 1917. James M. Hill. (Mineral Resources of the U. S., 1917—Part II; 1 p.)

9659—SULPHUR—Estado de la Explotacion del Azufre. T. Paredes. (Bol. Minero, Mexico, Nov. 1, 1917; 3½ pp.)

9660—SULPHUR—Utah Sulphur To Be Worked Upon a Large Scale. Will C. Higgins. (Salt Lake Min. Rev., June 30, 1918; 2 pp., illus.) 20c.

PETROLEUM AND NATURAL GAS

9661—CANADA—Petroleum in the Fraser Valley, British Columbia. E. A. Haggen. (Min. and Eng. Rec., Feb. 28, 1918; 3½ pp., illus.) 20c.

9662—MEXICO—Oil in Southern Tamaulipas, Mexico. Ezequiel Ordoñez. (Bull. 137, A.I.M.E., May, 1918; 7½ pp., illus). 40c.

9663—NATURAL GAS—The Chemical Possibilities of Natural Gas. J. B. Garner. (Chem. Engr., June, 1918; 9½ pp.) Extracts from a paper before the Nat. Gas Assn. of America. 20c.

9664—OIL SHALE of the Uinta Basin, Northeastern Utah. Dean E. Winchester. (Bull. 691-B, U. S. Geol. Surv., Apr. 30, 1918; 24 pp., illus.)

9665—OIL SHALES—Destructive Distillation of Oil Shales. J. C. Morrell and Gustav Egloff. (Chem. and Met. Eng., July 15, 1918; 6½ pp.) Description of products, influence of sulphur, oxygen and nitrogen content; commercial possibilities.

9666—ONTARIO—Oil Prospecting in Southwestern Ontario. M. Y. Williams. (Can. Min. Journ., Feb. 15, 1918; 2 pp., illus.) 20c.

9667—QUEENSLAND—The Roma Oil Bore. Prospects of Obtaining Motor Spirit from the Gas. W. E. Cameron. (Queens. Govt. Min. Journ., May 15, 1918; 2½ pp., illus.) 60c.

9668—TEXAS—Geology of the Oil Fields of North Central Texas. Dorsey Hager. (Bull. 138, A.I.M.E., June, 1918; 10 pp., illus.)

9669—VALUING—Methods of Valuing Oil Lands. (Bull. 137, A.I.M.E., May, 1918; 4¾ pp.) Discussion of paper of M. L. Requa previously indexed.

9670—WELL LOGS—A Concrete Example of the Use of Well Logs. Mowry Bates. (Bull. 137, A.I.M.E., May, 1918; 7½ pp., illus.)

ECONOMIC GEOLOGY—GENERAL

9671—MEXICO—The Relation of Sulphides to Water Level in Mexico. P. K. Lucke. (Bull. 138, A.I.M.E., June, 1918; 4 pp., illus.)

9672—ORE DEPOSITS—The Evolution of Ore Deposits from Igneous Magmas. W. H. Goodchild. (Min. Mag., June, 1918; 10½ pp.) Continuation of article previously indexed. 40c.

MINING—GENERAL

9673—ALGERIA AND TUNIS—Les Mines et la Metallurgie en Algerie et Tunisie. (L'Echo des Mines et de la Metallurgie, June 9, 1918; ½ p.)

9674—ARIZONA—The Chloride Mining District. Rush T. Sill. (Min. and Oil Bull., Feb., 1918; 3 pp., illus). 20c.

9675—CHUTES—Keeping Water Out of Chutes. Claude T. Rice. (Eng. and Min. Journ., July 13, 1918; ¾ p., illus.) 20c.

9676—CUBA—Reseña sobre la Minera durante el Año 1917. (Bol. de Minas, Havana, Cuba, Jan., 1918; 12 pp.) Includes figures of mineral exports.

9677—HAULAGE—Mule Haulage Underground at the Durban Roodepoort Deep Mine. A. P. Rouillard. (Journ. Chem., Met. and Min. Soc. of So. Afr., Aug., 1917; 2 pp., illus.) 60c.

9678—LIGHTING—The Safe Operation of Underground Electric Light Systems. L. Fokes. (Iron and Coal Tr. Rev., Feb. 8, 1918; 2 pp., illus.) 40c.

9679—MINE SURVEYING—Terrestrial Magnetism in Relation to Mine Surveying. C. Chree. (Iron and Coal Tr. Rev., June 14, 1918; 1 p.) Abstract of paper before the Brit. Instn. of Min. Engrs. 40c.

9680—PORTUGAL—The Mineral Industry of Portugal. Frederick W. Foote and Rastus S. Ransom, Jr. (Eng. and Min. Journ., July 13, 1918; 6¼ pp., illus.) 20c.

9681—QUEENSLAND—Silver Spur Mine; Recent Developments and Future Prospecting. Lionel C. Ball (Queensland Govt. Min. Journ., Apr. 15, 1918; 9 pp., illus.) 60c.

9682—RECOVERING CAVED STOPES in Narrow Veins—II. Claude T. Rice. (Eng. and Min. Journ., July 6, 1918; 6½ pp., illus.; to be continued.) 20c.

9683—SHAFT RELINING—Notes on Shaft Relining With Concrete. G. G. Stonemark. (Eng. and Min. Journ., July 6, 1918; 3 pp.) Refers to Shafts "A" and "C" at the Tener Mine, Chisholm, Minn.

9684—SPITZBERGEN—The Mineral Wealth of Spitzbergen. (Journ. Soc. of Chem. Ind., June 29, 1918; 1 p.)

9685—TIMBER POSTS—Cutting Round Timber Posts. L. D. Davenport. (Eng. and Min. Journ., July 6, 1918; ¾ p., illus.) 20c.

ORE DRESSING—GENERAL

9686—BELT CONCENTRATORS and Wet Concentration. Alex. McLaren. (Eng. and Min. Journ., July 6, 1918; 1¾ pp.) 20c.

9687—GRINDING of Ore in Ball-Mills. Algernon Del Mar. (Eng. and Min. Journ., July 6, 1918; 1¼ pp., illus.) 20c.

9688—MIDDLINGS. (Eng. and Min. Journ., July 6, 1918; 1¼ pp., illus.) 20c.

METALLURGY—GENERAL

9689—BRASS—Initial Stress and Corrosion Cracking. P. D. Merica and R. W. Woodward. (Advance copy, Am. Soc. for Testing Materials, June, 1918; 13¾ pp., illus.)

9690—RECENT METALLURGICAL PROGRESS, Notes on. E. P. Mathewson. (Eng. and Min. Journ., July 20, 1918; 7¼ pp., illus.) 20c.

9691—REFRACTORY BRICK—The Necessity for Inspection and Testing of Refractory Brick. C. E. Nesbitt and M. L. Bell. (Advance copy, Am. Soc. for Testing Materials, June, 1918; 10 pp., illus.)

9692—REFRACTORY MATERIALS—Native Supplies of Refractory Materials in the Sheffield District. W. G. Fearnsides. (Iron and Coal Tr. Rev., May 24, 1918; 1 p.) 40c.

9693—SAFETY APPLIANCES in Smelteries and Refineries. Geo. M. Douglass. (Eng. and Min. Journ., July 20, 1918; 4¼ pp., illus.) 20c.

SAMPLING AND ASSAYING

9694—NATURAL GASES—Analysis of Natural Gases. (Met. and Chem. Eng., June 15, 1918; 2 pp.) From the second edition of the U. S. Steel Corporation's "Methods for the Technical Sampling Analysis of Gases."

9695—RADIUM—The Bisulphate Method of Determining Radium. Howard H. Baker. (Journ. Ind. and Eng. Chem., July 1, 1918; 2½ pp., illus.) 60c.

FUELS

(See also "Petroleum and Natural Gas")

9696—CARBOCOAL. Chas. T. Malcolmson. (Bull. 137, A.I.M.E., May, 1918; 7 pp.) 40c.

9697—POWDERED COAL—The Possibilities of Powdered Coal as Shown by Its Combustion Characteristics. W. G. Wilcox. (Chem. and Met. Eng., July 1, 1918; 5¾ pp.) Paper before the Western New York Section of the Am. Chem. Soc., May 31, 1918.

9698—PULVERIZED COAL—The Use of Pulverized Coal. Ch. Dantin. (Eng. and Contr., May 29, 1918; 2 pp.) From Le Génie Civil, June 10, 1916.

9699—PULVERIZED COAL—Use of Pulverized Coal at the Bunker Hill & Sullivan Smelting and Refining Plant. C. T. Rice. (Eng. and Min. Journ., July 20, 1918; 3¼ pp., illus.) 20c.

9700—WEIGHTS of Various Coals. S. B. Flagg. (Tech. paper 184, U. S. Bureau of Mines, 1918; 14 pp.)

MINING AND METALLURGICAL MACHINERY

9701—AIR COMPRESSORS—Modern Air Compressors—I. David Penman. (Min. Mag., June, 1918; 8 pp., illus.; to be continued.) 40c.

9702—FOUNDATIONS—Repair Work to Heavy Foundations. Sidney Gill. (Iron and Coal Tr. Rev., June 14, 1918; 1¾ pp., illus.) Paper before Yorkshire branch of Nat. Assn. of Colliery Mgrs. (British). 40c.

9703—LAMPS—Combustion Tube Safety Lamps. (Iron and Coal Tr. Rev., June 7, 1918; 1¼ pp., illus.)

9704—POWER HOUSE—Economic Handling of Ashes. Reginald Trautschold. (Ind. Management, July, 1918; 3¾ pp., illus.) 40c.

MISCELLANEOUS

9711—LABOR—Cost of Constructing and Moving Portable Camp Buildings. (Eng. and Contract, June 19, 1918; 1¼ pp., illus.)

9712—MINERAL WATERS in 1916. Arthur J. Ellis and Alfred L. Chambers. (Mineral Resources of the U. S., 1916—Part II, Mar. 13, 1918; 48 pp., illus.)

9713—POWER—Electric Power for Mining in Yavapai County, Arizona. (Eng. and Min. Journ., June 22, 1918; 4¼ pp., illus.) 20c.

9714—STATISTICS—Report of the Committee on the Standardization of Mining Statistics. Albert H. Fay. (U. S. Bureau of Mines, 1918; 39 pp.)

9715—WAR—American Chemists' Defensive Measures Against Gas Attacks in France. R. K. Tomlin, Jr. (Met. and Chem. Eng., June 15, 1918; 3 pp., illus.)

Personals

Have You Contributed to the Association of the 27th Engineers?

L. H. Goodwin has gone with Rogers, Mayer & Ball, 42 Broadway, New York, as office and field assistant.

John Seward has been assigned to the executive division of the General Staff, at Washington, D. C., with rank as major. He will specialize on war minerals.

Hugh Lee has resigned his position with the Porcupine Crown Mines, Ltd., at Porcupine, Ont., to become lecturer on metallurgy at the Pennsylvania State University.

E. F. Flad, formerly in charge of the Youngstown, Ohio, slag-crushing plant of the Carnegie Steel Co., has been made chief construction engineer and efficiency expert.

Dr. E. L. Bruce, of the Canadian Geological Survey, is making an examination of the Star Lake district, Manitoba, where discoveries of molybdenum and scheelite have been made.

J. W. Crowdus, 222 Mills Bldg., El Paso, Tex., has been commissioned first lieutenant in the Engineer Reserve Corps, and has been ordered to Camp Lee, Petersburg, Va., for duty.

H. W. Aldrich has resigned his position with the Anaconda Copper Mining Co. to become assistant general superintendent of the Inspiration Consolidated Copper Co.'s plant at Miami, Arizona.

J. Esdaile Florance and **William H. Hampton,** mining and consulting engineers of 68 Broad St., New York, mutually dissolved partnership on July 1, 1918, each resuming independent practice.

H. M. Hanna, Jr., has been elected president of the Detroit Iron and Steel Co.; **Frank B. Richards,** vice president; **R. S. Grant,** secretary; and **W. S. Whitcomb,** assistant secretary and treasurer.

R. J. Ennis, general manager of the McIntyre Porcupine Mines, Ltd., at Porcupine, Ont., was in Toronto recently in connection with plans for the extensive development of the Newray property.

A. L. Sweetser, recently mining engineer and chemist for the International Carbon Products Co., and the Huff Electrostatic Separator Co., is now engaged in war mineral research work for the Federal Government.

B. Magnus has been commissioned captain in the Engineers' Reserve Corps, and is now on active duty. He requests that all communications for him be addressed care of Henry M. Toch, 320 Fifth Ave., New York City.

W. R. Ingalls delivered an address on "Benefits To Be Derived from Close Cooperation of Zinc Mining and Smelting Interests in Helping Win the War" at the meeting of the American Zinc Institute at St. Louis, Mo., on July 30.

Edwin O. Daue, formerly manager of the Dolores Mines Co., Madera, Chihuahua, Mex., and later general superintendent of the Primos Mining and Milling Co. and Primos Chemical Co., Lakewood, Colo., has been commissioned captain in the U. S. R. Engineers.

Prof. Mortimer E. Cooley, of the University of Michigan, has been nominated for president of the American Society of Mechanical Engineers for 1919. F. R. Low, editor of "Power," New York; Henry B. Sargent, of New Haven, Conn., and John A. Stevens, of Lowell, Mass., have been nominated for vice presidents.

Stuart B. Marshall, formerly manager of the American Manganese Manufacturing Co., at Dunbar, Penn., and until recently general superintendent of the property and business at Badin, N. C., of the Aluminum Co. of America, is now established at Roanoke, Va., as consulting engineer, chemist and metallurgist for coal and ore lands, blast furnaces and deposits of manganese, pyrites and other minerals.

Obituary

Joseph Rosenberg, a retired smelter, died recently in Brooklyn, N. Y., aged 75 years.

Prof. Stephen F. Peckham, chemist, died in Brooklyn, N. Y., on July 11, aged 79 years. He was at one time connected with the Geological Survey of Minnesota as chemist.

Charles Cetewayo, who claimed to be the son of the late King Cetewayo of Zululand and a protege of Queen Victoria, died on July 23 at Kingston, Ont. He was a mining engineer and had been engaged in the examination of mica properties near Westport, Ontario.

John Duir Irving, who joined the New York Engineering Corps at the outbreak of war, being among the first in the Yale faculty to volunteer for active service, died recently in France from pneumonia. Dr. Irving was born in Madison, Wis., in 1874, and graduated from Columbia University in 1896, receiving the degrees of Master of Arts and Doctor of Philosophy. He later became professor of economic geology at Yale University, was given the honorary degree of Master of Arts there in 1907 and was widely known as an authority on ore deposits. Further details of his career will be published as a complete biography in a subsequent issue of the "Journal."

Societies

American Society for Testing Materials, in coöperation with the American Society of Civil Engineers, the Bureau of Standards, the Bureau of Foreign and Domestic Commerce and the Office of Public Roads, is preparing a series of Spanish-English pamphlets for distribution throughout Latin America and Spain as a means of promoting trade. The first of the series has already been published under the title "Standard Specifications and Tests for Portland Cement," and will be followed by others on subjects such as carbon-steel rails, open hearth steel girders and high tee rails. The pamphlets will accurately define generally accepted American industrial standards for construction materials.

American Institute of Mining Engineers. Probably 40 or 50 technical subjects will be discussed at the war-work meeting of the Institute, to be held in Colorado on Sept. 1 to 6, the program of which was given in much detail in last week's issue. Among these subjects are the following: "The Byproduct Coke Oven and Its Products"; "Development of the Coke Industry in Colorado, Utah and New Mexico"; "The Possible Existence of Deep-seated Oil Deposits on the Gulf Coast"; "The Manufacture of Ferroalloys in the Electric Furnace"; "Electrostatic Precipitation"; "The Effect of Oxygen Upon the Precipitation of Metals From Cyanide Solutions"; "Roasting for Amalgamating and Cyaniding Cripple Creek Sulphotelluride Gold Ores"; "Pyrites Deposits of Leadville, Colo."; "Molybdenite Operations at Climax, Colorado"; and "Radium."

Industrial News

Aspromet Company, formerly the Asbestos Protected Metal Co., of Pittsburgh, has opened an office in the Munsey Bldg., in Washington. O. O. Robinson, district manager, and H. E. Marks, general sales manager, will be in charge.

Denver Engineering Works Co., Denver, Colo., announces that, at the annual meeting held in June, 1918, the following directors and officers were elected: Board of directors: H. W. Hardinge, Frank E. Shepard, William W. Torrence, Robert J. Pitkin, Richard B. T. Kiliani. Officers: Frank E. Shepard, president; Richard B. T. Kiliani, vice president and treasurer; William W. Torrence, general manager; Robert J. Pitkin, secretary. In addition to the manufacture of Hardinge conical ball mills, the company will continue to manufacture mining and milling machinery, electric hoists, mine timber framers, cylindrical ball mills, Richards pulsator jigs and classifiers, Ovoca classifiers and similar equipment.

Trade Catalogs

Cameron Centrifugal Pumps. A. S. Cameron Steam Pump Works, 11 Broadway, New York. Flyer; form 909, illustrated. Relates to pumps for condenser service.

Vertical Triplex Power Pumps. Worthington Pump and Machinery Corporation, 115 Broadway, N. Y. Deane Works, Catalog D-702; pp. 56; 6 x 9; illustrated. Descriptive of single and double-acting pumps of type named.

Wire Cloth, Perforated Metals, Etc. Multi Metal Co., Inc., 247-253 W. 19th St., New York. Catalog and price list, 1918, pp. 20; 7½ x 10½; illustrated. Contains information interesting to the user of bolting, sifting and filtration materials.

"Pentarco" Distilled Pine Products. Pensacola Tar and Turpentine Co., Gull Point, Fla. Catalog and price list; pp. 16; 3½ x 6; illustrated. Discusses pine tar, pine oil, tar oil, pure pine flotation oils and gives a formula for making "Pentarco" oils soluble.

Roots Rotary Gas Exhausters. P. H. & F. M. Roots Co., Chicago, Ill. Catalog No. 63; pp. 40; 8½ x 11½; illustrated. The predominating feature is the publication of tables of engineering data, making the catalog useful as a reference work to any one interested in the manufacture or use of gas.

Nonpareil Insulating Brick. Armstrong Cork and Insulation Co., Pittsburgh, Penn. Leaflet; pp. 4; 3½ x 6; illustrated. Copies free upon request. These brick are made of kieselguhr mixed with cork, the cork being later burned out, leaving a porous brick that will resist temperatures up to 1650° F. without change.

Green Sealflex Arches. Green Engineering Co., East Chicago, Ind. Pamphlet; pp. 14; 3½ x 6¼; illustrated. This little book, issued under the title "Capacity," describes as an improvement in furnace design a long, flat arch known as the "Sealflex," for which several advantages are claimed over the old-style flat and sprung arch. "Geco" arch tiles, designed and made by the company, are used in the arch described.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Hydrometallurgy—Method of Recovering Metals from Solution. Rudolph Gahl, Miami, Ariz. (U. S. No. 1,269,418; June 11, 1918.)

Alumina, Treatment of Insoluble. Howard F. Chappell, New York, N. Y., assignor to Mineral Products Corp., New York, N. Y. (U. S. No. 1,270,266; June 25, 1918.)

Amalgamator. Benjamin Q. P. Foss, San Francisco, Calif., assignor to the Foss International Ore Reduction Co., San Francisco, Calif. (U. S. No. 1,270,399; June 25, 1918.)

Concentrating Table, Submerged. William A. Huelsdonk, Modesto, Calif. (U. S. No. 1,270,736; June 25, 1918.)

Drill Sharpener. William A. Smith, Denver, Colo., assignor to the Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,270,667; June 25, 1918.)

Furnace with Conveying Apparatus for Treating Certain Mineral or Chemical Products. Charles J. Leyes, Jersey City, N. J. (U. S. No. 1,270,307; June 25, 1918.)

Phosphate and Potash—Process of Producing Potassium and Phosphorus Compounds. Edward W. Haslup, Bronxville, N. Y., and Benjamin A. Peacock, Philadelphia, Penn. (U. S. No. 1,270,515; June 25, 1918.)

Aluminum, Process of Making Chloride of. Dillon F. Smith and Harry Essex, Pittsburgh, Penn., assignors to Gulf Refining Co., Pittsburgh, Penn. (U. S. No. 1,270,226; June 18, 1918.)

Concentrator. John K. Turner, Portland, Ore., assignor to Lillie Turner, Portland, Ore. (U. S. No. 1,269,760; June 18, 1918.)

Dredge, Gold. Lorenzo R. Gage, Sr., Hoquiam, Wash. (U. S. No. 1,270,142; June 18, 1918.)

Filtering Process. Albert Legrand Genter, Salt Lake City, Utah, assignor of one-half to the General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,269,700; June 18, 1918.)

Manganese, Process of Making Dioxide of. Carleton Ellis and Alfred A. Wells, Montclair, N. J., assignors to National Carbon Co., Long Island City, N. Y. (U. S. No. 1,269,915; June 18, 1918.)

Oil Shale, Method of Treating and Apparatus for. Lebbeus H. Rogers, New York, N. Y. (U. S. No. 1,269,747; June 18, 1918.)

Ore Dressing—Ore-Separating Device. Roderick W. Haddock, Independence, Ore. (U. S. No. 1,269,704; June 18, 1918.)

Phosphate—Process of Producing Gas and Phosphatic Fertilizer Material. Alberto, Francesco Delacourt, Genoa, Italy, assignor to Societá Anonima Italiana Gio. Ansaldo & C., Genoa, Italy. (U. S. No. 1,269,795; June 18, 1918.)

Editorial Correspondence

SAN FRANCISCO—July 22

Baja California Gold is again attracting attention. Display was recently made at San Diego, Cal., by J. F. Delgado & Co. of high-grade ore taken from property said to be situated about 30 miles from Campo, and owned by Mexicans who have been developing and mining for several years. They use the primitive arrastre, driven by burro power, for separating the gold. Although the ore is reported to be rich, the owners are not getting rich. There are also some rich silver leads in the southern part of the peninsula, but, like the gold properties, they lack modern methods of mining and metallurgy essential to the development of profitable mines. Baja California awaits not only northern enterprise, but the eradication of Mexican rule. However, the political conditions are not as bad on the peninsula as in Mexico proper.

A Decrease in Oil-Well Drilling of 31% in California fields during the first six months of 1918, as compared with the like period of 1917, shows plainly the need of renewed attention to the subject of oil-field development and emphasizes the necessity of preparation on the part of operators —not only preparation for development of areas known to contain possible oil measures, but the avoidance of drilling in ground where no positive indications of oil appear. Wildcatting is an essential part of the program for the thorough prospecting and development of oil-bearing lands. But wildcatting for the mere purpose of exploiting and promotion is not only detrimental to the oil industry, but is a reprehensible practice that should be discouraged by legal authority, which may or may not rest in the powers of the oil and gas supervisor. If the law does not provide this power, there is no valid reason why the law should not be amended.

Chrome Ore in California is held by a recent decision of the U. S. Land Office to be subject to location and development on railroad land. William Hales and associates made four locations on Central Pacific lands in Placer County. These lands are now held by the Power Timber Co., assignee of the railroad company, which claimed that the right to possession was vested in the assignor by the law of 1864. Hales and associates contended that chrome iron ore, which produces chromium, is a special mineral that is not to be classed as iron, as the important content of the ore is not iron but chromium, and extremely valuable to the Government at the present time. Both the local land office at Sacramento and the General Land Office at Washington approved the contention and awarded to the locators the right to proceed with development and production under their locations. That the land office acted upon no precedent may give rise to other or further contention that chromic iron is more iron than chrome, but the fact is established without recourse to precedent of legal action that if there were more iron in the chrome ores than chromium the percentage of chromium would not be high enough to warrant its development for chromium content. And the railroads could keep it and welcome. If the demand for California iron ores were sufficient to warrant extensive mining of iron, the iron miners would not hunt for commercial iron properties in the chromic iron fields. The land office decision has the merit of common sense, which is sometimes practiced irrespective of precedent.

YREKA, CALIF.—July 22

The Chrome Interests of Siskiyou have been advised by Congressman Raker that the Government will at once begin work on the construction of roads into the chrome deposits of the Scott and Klamath River section, where many new chrome deposits are being developed. The county has appropriated $10,000 to assist the Government in opening these highways, which, it is estimated, will cost $97,000. One hundred heavy trucks will be required to handle the output of the new districts.

The Mining of Manganese is a new industry in the central part of Siskiyou County. Several deposits have been found, but heretofore none have been extensive enough to interest capital. A number of high-grade deposits have been uncovered between Forks and Salmon and Orleans Bar, which will be operated as soon as a road is built. The manganese mines now operated by the Western Metals Co. are within a radius of 18 miles from Yreka. The deposit in Cottonwood district near Black Butte is within a short railroad haul of the Ager. This mine is an open cut with 1000 tons of 45% ore in sight. The company's other principal property is in the Deadwood district six miles from Fort Jones.

BISBEE, ARIZ.—July 22

Production of Manganese is being rushed by the Phelps Dodge Corporation, which has found the metal in a number of its local copper workings. Last month 600 tons of high-grade manganese went direct to the Alabama works of the Tennessee Coal, Iron and R. R. Co. This month the shipments will approach 1000 tons.

The Copper Queen Steam Shovels will begin by the end of August the actual mining of chalcopyrite ore on Sacramento Hill for the test concentrating mill. The rock has proved much harder than expected, a condition met simply by the use of more dynamite. Some difficulty is being found in disposal of the waste, which now is being dumped into ravines near the Spray shaft. It is not improbable that it will be used later in the leveling of a large tract of land at Warren.

Mines of Arizona Will Profit Little or not at all by the lift of the copper price from 23½ to 26c. Here is the way the added 2½c. will go: The railroads, under the rate increase effective June 25, take 1½c; the Eastern refineries will get ½c. and the wage advance represents ⅜c. These items absorb the raise, and there still must come the added state and national taxes on the higher gross income, leaving the producer possibly a bit worse off than he was before the advance in both price and taxes. The strike in Bisbee last summer is estimated to have lost the nation about 19,000,000 lb. of copper, worth about $4,700,000. Had the reign of terror not been broken by the deportation, it is probable that production hardly could have been re-established within 90 days, and the loss would have been six times as great. The suits in connection with the deportation claim gross damages approximating $5,000,000, or about the value of the copper product for the period of paralysis of actual production in the Bisbee camp. Consequently it has been computed that the deportation may have had a patriotic result well worth even the maximum possible cost, in the event that judgments be secured for the sums claimed. The immediate resumption of production at the mines undoubtedly added many millions of dollars' worth of copper to the national assets. During 1917 the mines of Arizona paid in wages approximately $65,000,000 and in war taxes $24,000,000. The total copper output was 716,487,197 lb., with gross marketed value of $182,874,577. The large relative importance in Arizona of the copper industry is shown by the valuation of all other mineral products of the state at $16,903,350.

JEROME, ARIZ.—July 22

The United Verde Extension Smeltery is to cast its first bullion soon. The first unit, a 500-ton blast furnace, already has been fired up several times in experimental testing of ores and fluxes in order that there may be no doubt of the proper charges at the time of the real start. About 10,000 tons of ore that averages around 15% copper is in the bins. This single furnace has a possible output of 4,500,000 lb. of copper a month. Three converter stands are in place and ready. A reverberatory furnace, also of 500 tons' capacity, is under construction, and a second reverberatory is to be added for emergencies. Six Wedge hearth roasters are to be in operation within a few months. The bedding bins are of concrete, with 9000 tons' capacity, and the steel receiving bins hold 1500 tons. The firing of the reverberatories and boilers with powdered lignite coal, under air pressure, will be in the nature of an experiment, the coal to be of the ordinary Gallup variety. Another innovation is the flooring of the converter shed with about 400 tons of ore, with the idea that the endless shoveling of overflow matter shall have admixture of something more valuable than ordinary dirt. Dominating the landscape is the 425-ft. stack, 30 ft. in diameter at the bottom and constructed of 7000 tons of molded brick. Gases go to it through a 20 x 25-ft. flue that is 1000 ft. long. Most of the building has been constructed with brick, though there was disappointment in not finding local clays suited for brick making, resulting in delay and much added expense. The water supply now is 350 gal. a minute, with a saving accomplished by the cooling and re-use of the flow from the furnace water jacket. A modern power plant has been provided, with electricity, generated at the works, used wherever practicable. The new plant was begun on Apr. 14, 1917. Nearly 800 men now are employed, but only 300 will be needed for operation of the completed plant. A new town, Verde, is to be built of brick and concrete, a half-mile distant. Plans for the works were drawn by A. G. MacGregor. Thomas A. Stiles has been in charge of construction. Barry Hogarty is superintendent, assisted by John A. Rule. H. O. Hammond is in charge of the laboratory. At first the ore supply must come in roundabout fashion, by way of the United Verde Ry., through Clarkdale. The 12,384-ft. haulage tunnel will later give outlet for the ores on the 1100-ft. level. Of this tunnel about 3000 ft. remain to be driven; the work has been pushed by the Potter Construction Co., of St. Louis, but is going slowly at present.

MOGOLLON, N. M.—July 18

New Cyanide Mill of the Socorro Co. is nearly ready to start. The various sections have been tried out and regular production will begin soon. Ore will be dumped from skips into steel ore bin in headframe. Two jaw crushers 13 x 24 in. and 10 x 20 in. will reduce ore to 1-in. ring. Belt conveyor transfers ore to circular flat-bottom storage bins at mill. A pan conveyor running under this feeds two Hardinge ball mills, the fines going to slime plant and the coarse to two tube mills. The slime plant consists of Pachuca tanks, Dorr thickeners and Burt filters. Zinc shavings are used in precipitation and steel Harvey furnace for melting bullion. The capacity is 250 tons per day. All machinery is motor-driven, power being generated by De La Vergne oil engines.

CALUMET, MICH.—July 23

The Labor Situation in the Michigan copper district is steadily becoming worse. The draft and the call of the higher wages offered in the munitions factories are taking the men. Calumet alone has sent close to 1000 into the Army. The city of Detroit has taken hundreds, and other cities, with their big plants, are taking men steadily. Many of the machinists and other skilled workmen have gone to the shipyards and other Government plants. The result is that most of the mining corporations are showing decreased production. In June they almost held up to their May records, but July will show a falling off, it is believed. Whether or not another increase in wages would solve the labor question is a matter of doubt. Hancock and Isle Royale stand out among the mines as exceptions to the general rule of decreased tonnages. Hancock has almost doubled its tonnage in a month. Isle Royale will this month practically equal the June output, which set a new high record for the property.

The Calumet & Hecla Co's. Operations for the recovery of the slight copper content of the stamp sands is becoming more and more important year after year as the company adds to its equipment for working over the old sands, and a recovery of copper is now being made from this former waste material that is greater than the recovery from amygdaloid rock. For many years stamp sand has been used in the building of highways, in making concrete for construction work, in laying sidewalks, and for similar uses. It was estimated, when the plans were made for building the regrinding plants, that about 37½% of the copper contained in the sand could be recovered. No. 1 regrinding plant, how-

ever, started recovering an average of 40% of the copper. No. 2 plant was then constructed, and a leaching plant, to still further increase the recovery, was put up and handled 2000 tons of sand per day. Regrinding and leaching brought the recovery of copper up to about 75%. A second unit of the leaching plant was constructed, doubling the capacity, and then the company turned its attention to oil flotation as a means of still further increasing the recovery. Experiments proved successful, and a plant is being installed. Foundations are now going in and the 17-unit plant will take care of the slimes from approximately 5000 tons of stamp sand or tailings per day. When the entire plant is in operation, the cost of copper from the stamp sands will, it is expected, be reduced to around 4c. and perhaps even lower. This would be the lowest-cost copper produced in the district.

SPOKANE, WASH.—July 22

The International Mining Convention, held at Revelstoke, B. C., July 8 to 11, which was attended by mine owners and operators from both sides of the line and by influential officials and representatives of mining industry of British Columbia, heard five important addresses. The Hon. William Sloan, Minister of Mines, described the good results attending the subdivision of the province into seven mineral districts, in charge of competent engineers. Thomas French, mining engineer, discussed the trouble between the smeltery at Trail and the mine owners. He said in part: "If the smeltery could recover 20% of the 25% that is lost at present it could give the miner the additional $23 for an ore containing 60% lead and still make as great a profit as at present. The loss of lead need not be more than 5% if the smelting operation is properly conducted, and the smelter should be given no rest until this result is attained." Managing Director J. J. Warren, of the Consolidated Mining and Smelting Co. of Canada, replied that the fundamental trouble which has prevented making better terms with mine owners is the general refractory character of the ores of the district and the absence of sufficient quantity of local clean lead ores to dilute the zinc content of the refractory ores. S. G. Blalock, assistant general manager of the same company, reviewed the work of the smeltery during the war and its inestimable service to the Allied cause. A. G. Langley made an address on "Discovery and Development of Prospects"; Bruce White reviewed the "Geology and Mineral Resources of the Revelstoke District"; the Hon. John Hart, Minister of Finance, discussed mine taxation; A. B. Clabon made an address on the "Value of the Mining Industry," and W. Orville Young one on "Northwest Kootenay." A paper by Dean Milnor Roberts of the Washington State University on the aid that has been given mining by state and Federal authorities was read by Professor Crowell, of Indiana University. A resolution in favor of a royal commission to investigate smelting plants was tabled for future consideration.

COBALT, ONT.—July 22

The Rising Costs of Mining are again exemplified by the increased tariff for concentrates from Cobalt. The A. S. & R. Co., which handles a considerable proportion of the table and flotation concentrates, has raised the rate for these products. Flotation concentrates now going to Denver will hereafter have to pay a treatment charge of $15 per ton. As there is a 5% deduction and an $18 freight rate, the total cost of freight and treatment will be about $45 per ton, or approximately 20% of the value of the product. There seems to be slight justification. It works a hardship on the mines of the district, and offsets, to a great extent, the benefit that the Cobalt district has experienced by the flotation process.

Aid to Gold Mining has been proposed, but so far as the Canadian government is concerned, it is doubtful if any direct aid will be given. Proposals have been made to abolish taxation and duty on mining machinery and chemicals used. This, however, would be a small factor, and if the gold mines are not able to make a reasonable profit with the present taxes and duties, it is certain that cutting off these items would not result in their remaining open. The two chief factors which have resulted in the closing down of the gold mines of this district are the high costs of all materials used and the scarcity and inefficiency of labor. It would be practically impossible to commandeer labor that would give satisfactory results in the mines, and it would seem that the gold-mining companies must endure present conditions until such time as the costs of materials decline and there is a sufficient supply of labor to guarantee efficient work.

The West Dome Consolidated Mines in its recent report gives little encouragement to the stockholders, and the results are so greatly at variance with what was expected that the dissatisfaction expressed with the Dome report is immediately called to mind. The report of this latter company is such as to justify a thorough investigation by a shareholders' committee. The last two annual reports have shown a decided falling off in grade and tonnage. In the annual report of the West Dome for the year ended May 31, 1918, the estimate of the ore reserves by the then manager of the company was $2,020,000. Independent reports by two other engineers show reserves at that time of only $113,032, only partially developed. Since then 2000 tons, averaging $8 per ton, has been added to the reserves. Cash on hand amounts to $38,000. The company has been advised to close down the property until conditions become more nearly normal.

VICTORIA, B. C.—July 22

Deposits of Strontianite, the carbonate of strontium, have been found on the lower Ashnola River, Similkameen district, B. C. No development work of consequence has been done, but the discoverers believe that there is a considerable body of the ore. Owing to the special use to which the mineral is being put, the prospect has attracted more than usual attention.

The Rosebery-Surprise Mining Co. has taken a bond on the Ivanhoe group, the property of the Minnesota Silver Co., owned largely by W. H. Yawkey, of New York. The deal includes the concentrator which was put up by the Surprise Company under agreement with the Minnesota Silver Co., to replace the mill destroyed by fire several years ago. Work on the Ivanhoe has been started by the Rosebery-Surprise forces, and negotiations are under way for the acquisition of the Canadian group, adjoining the Ivanhoe, and owned by Brandon Bros., of Silverton. D. McKenzie, formerly superintendent of the Ruth mines, will be in charge of operations at the Ivanhoe. Shipments were made from the Ivanhoe several years ago, but the mine did not prove profitable under the then prevailing prices of metals. The mine product is silver-lead-zinc milling ore.

The Encouragement of Gold Production by the state in British Columbia is to be hoped for, as the effects of increasing cost of mining and the augmented prices of other minerals have been felt to a serious extent. A notable case in point is the closing down of the Rossland mines by the Consolidated Mining and Smelting Co. of Canada. It is felt that, under the exceptional conditions, some effort should be made to maintain the output of gold, which is steadily declining in British Columbia. A resolution passed by the Northwestern Mining Association at a meeting held at Spokane, Wash., was as follows: "Resolved, That all war taxes be remitted, in so far as they affect gold mining; that present advance in freight rates be abrogated in respect to gold mines; that motor roads be built to hitherto inaccessible commercial gold mines; that the industry be placed on the same basis as other war industries in respect to financial assistance; that operators be given a guaranty which shall assure them profits commensurate with those that would have accrued under pre-war conditions, and that any and all acts of the government directed to the financial aid of the gold-mining industry shall be subject to mining and accounting experts acting on behalf of the government."

SYDNEY, N. S. W.—May 30

The Federal Treasurer Has Granted a syndicate the necessary permission to form a company to take up certain leases at Eaglehawk of the Bendigo Amalgamated Co. which the company has intimated that it is ready to hand over to any other party willing to work same, provided suitable arrangements are made regarding the plant and equipment. The new syndicate claims to be in a position to spend £25,000 on the leases, and it is reported that provided certain conditions were complied with and the proposed scheme of developmental work were satisfactory to the department, the Ministry would advance £10,000—the maximum allowed by the Mining Development Act—spread over a term of years.

Broken Hill Proprietary Co. is calling meetings to sanction the increase of capital from £1,500,000 to £3,000,000. The scheme of redistribution of shares amounts to the exchange of 10 shares of 8s. each for 13 shares of 20s. each, besides certain bonuses. The increase is fully warranted by the steel business at Newcastle, N. S. W. Large extensions are necessary to cope with the commonwealth's requirements for rails, ship plates, and structural steel. During 1917, about 360,000 tons of 60% iron ore was mined at Iron Knob, South Australia, and made into various forms of merchant steel by this company. The April output was below normal and in round figures was 10,000 tons. Another blast furnace is to start in August.

The British Government Contract for zinc supplies, as originally planned, called for 100,000 tons of zinc concentrates and 45,000 tons of spelter per annum for the next 10 years, but it has since been modified and now calls for 250,000 tons of zinc concentrates per annum until the war is over and for one year after, and 300,000 tons per annum for the nine years following. If the war is not over in 1918, the contract will last 11 years or more. Allowing for the requirements of the two Australian electrolytic zinc works, only one of which is at present built, there would still be far more to export to England than present or projected works there could treat. Even if all the Belgian and French spelter works are reëstablished under Allied control, there will still be a large surplus of zinc concentrate.

The Potentialities of the Papuan Oil Field are still undetermined, although six years have now elapsed since the first indications of petroleum were revealed in Papua, although the Commonwealth's experimental operations have extended over practically the whole of that period. Seven bores have been sunk up to date, and from these 2000 gallons of oil have been extracted. The result of boring operations from 1913 up to the beginning of the present year is as follows:

Bore	Begun	Depth, feet	Result
No. 1	Jan. 16, 1913	242	Oil at 224 ft.
No. 2	Apr. 8, 1913	133	Gas only
No. 3	Apr. 2, 1913	460	Little oil at 320 ft.
No. 4	Feb. 19, 1914	312	Gas only
No. 5	Aug. 6, 1914	395	Small production
No. 6	Sept. 28, 1915	500	Little oil
No. 7	Oct. 23, 1916	1800	Little oil at 190 ft.

From the beginning of operations to June 30 last £64,955 has been spent on the field. The annual salaries amount to £7342, exclusive of administrative charges, and £1800 a year for native labor and maintenance. Drilling plants delivered on the field have cost £12,052. This amount includes the cost of the rotary drilling machinery (£7000), which is now lying idle on the oil fields, for the reason that the section manufactured in America cannot be adjusted with the parts supplied by a Sydney firm.

New Electrolytic Works are being built at Kandos, near Lithgow, N. S. W. Operations are to start on a small scale with a capacity of only 2500 tons per year and will be primarily for the treatment of copper from the C. S. A. mines, Cobar, but the plant will also be able to treat copper from practically all of New South Wales. There have been three electrolytic works for copper in Australia; the first being at Wallaroo mines, South Australia, which is now closed, as the company finds it more profitable to make furnace-refined copper. The second was established at Lithgow, N. S. W., and treated blister copper from Great Cobar, but was dismantled when the Great Cobar mine was sold to an English company. The third and largest, the Electrolytic Refining and Smelting Co., of Port Kembla, is now the only plant in Australia producing electrolytic copper and also the only customs works for copper ores. The backbone of the new electrolytic works at Kandos will be the C. S. A. mines, producing about 250 tons monthly and now shipping to the Port Kembla works. The situation is well chosen for iron, lime, water, coal and labor, and the railway lines provide communication with the western, northern and southern districts. Those in charge of the erection and operation of the works were concerned in the establishment of the three above-mentioned plants.

The Output of Molybdenum Tungsten and Bismuth in Australia is expected to increase largely in 1918 and 1919. In New South Wales the three mines near Bathurst, have over 1,000,000 tons of rock, from which they may expect to recover over 1% of molybdenite concentrates. One of them, the Mammoth, has its first unit of 10 stamps now at work, and the others are being equipped. Near Glen Innes, N. S. W., the Kingsgate pipe deposits are now in the hands of a strong Melbourne company, which will open many more of the 50 known pipes than were formerly worked. In Queens-

land, the Thermo Electric Co., of Luton, England, has acquired controlling interests in most of the big mines of the Wolfram Camp district fo North Queensland, and is erecting large mills. In other parts of Queensland, New South Wales, Victoria and the three other states, many small mines of molybdenite, tungsten and bismuth are now being worked. The sale of the three products has, since the war, been in the hands of Messrs. Dalgety, as imperial agents. The firm of Messrs. Dalgety has extensive wool and cattle interests in all the states, and already having numerous branches, is able to handle the business in excellent manner. It is no fault of that concern if the unit price in Australia is far below that in the United States and Canada. The Queensland agency will now be in the hands of the Thermo Electric Company.

The Bendigo Amalgamated Co. has not yet been successful in making any discoveries of a promising character and has even found considerable difficulty in keeping up the output to an average of 5000 tons of ore per week. It has been decided to concentrate operations in the more central portions of the holdings, as it is believed the opportunities there fully justify exploratory work. With this object in view, operations on the Eaglehawk areas have been stopped, and in order to take advantage of the present high prices ruling for second-hand machinery and scrap iron, also to provide the necessary funds to maintain development work, the plants on these mines have been sold. Since the inception of operations over £13,000 has been realized from this source, and on the other hand the company has spent £23,000 on the installation of new or the improvement of old plants. The aim of the management is to centralize operations to a much greater extent than under old conditions. It is proposed to maintain sufficient mills to treat approximately 8500 tons per fortnight. These mills are the Virginia, Johnson's No. 2, Nelson, Koch's Pioneer, Carlisle, Consols and Garden Gully. With the exception of the Virginia mill, the power will be supplied by suction gas plants with wood producers. Efficient air compressors are being concentrated into three main stations at Koch's Pioneer, Virginia and Johnson's No. 2. These stations are now well on the way to completion, and will provide for from 150 to 180 rock drills. This will enable the company to discard a considerable number of obsolete compressors, which it is now compelled to run at extravagant cost. The policy is to maintain about 30 winding plants of modern type.

The Mining News

ALABAMA

Jefferson County

SLOSS-SHEFFIELD STEEL AND IRON (Birmingham)—Plans to erect 120 Semet-Solvay byproduct coke ovens at North Birmingham. The cost of the plant will be approximately $5,000,000. The Government will take all of the byproducts, except gas and tar, which will be disposed of locally.

ARIZONA

Mohave County

BERKELY (Kingman)—Reports uncovering of ore in the old property at depth of 18 ft. Shaft sinking being rushed.

GOLD TRAIL MINING (Kingman)—Intends to reorganize and begin development. Mines known as the McKeeson property.

STANDARD MINERALS (Kingman)—Opened rich vein in crosscut from 300 level. To sink to 500 level soon.

WASHINGTON-ARIZONA (Kingman)—Getting ready for operation. Has mill and has opened large tonnage of ore.

Pima County

BLACK BESS (Ajo)—Ore containing tungsten, gold and molybdenum is being developed and mined.

BULLION BAR (Ajo)—Improvements being made preparatory to beginning operations; include several dwelling houses.

GUNSIGHT GOLD AND TUNGSTEN (Ajo)—Articles of incorporation have been filed. Capital stock $500,000 in shares of $1 par value.

Pinal County

SILVER KING (Superior)—Vein tapped on 400 level near shaft was crosscut 15 ft. and drift run on vein 22 ft. It contains streaks carrying high-grade silver. Mine idle for years.

Santa Cruz County

MOWRY (Patagonia)—Shipping manganese ore to smeltery.

Yavapai County

PHILADELPHIA MINING (Crown King)—Owns and operates the Nelson Co. properties. George P. Harrington is manager.

BELT (Humboldt)—Shipped carload silver ore to Grey Eagle Reduction Company.

CALUMET & JEROME (Jerome)—Diamond drilling to supersede other methods of development. Several holes to be put down from 600 level. Crosscut No. 1 is in 2000 ft. south from 600 station. No. 13 is being advanced.

JEROME GRANDE (Jerome)—Financing for extensive operation. Stock sales in June heaviest in history of company. No resumption of operations until the Jerome-Prescott auto road is built.

JEROME VERDE (Jerome)—Work concentrated in main top ground and in crosscut on 1050 level. Grade of tunnel from Columbia to Maintop corrected for drainage and haulage. A station finished at 1000 level.

VERDE COMBINATION (Jerome)—Small stringers of best ore found prominent at 1080 ft. in shaft, where station is being cut. Drifts to be started east and west. Dave Morgan is manager.

ARIZONA-BINGHAM (Mayer) — Last rich strike made on 600 level. Mill treating 175 tons daily and showing better than 95% recovery.

BIG BUG (Mayer)—Shaft started on outcrop which shows strong copper stains for 2000 feet, and at 50 ft. ore was encountered.

COPPER QUEEN (Mayer) — Entirely new orebody encountered 500 ft. below main adit level. Vein about 20 ft. wide; contains some ore of shipping grade.

COPPER MOUNTAIN (Mayer)—Shaft sunk to 250 level and to be sunk to 500 level. At 100 level a shoot of ore was cut.

POCAHONTAS (Mayer)—Constructing mill and machinery for 50-ton flotation unit on the way.

CROWN KING DISTRICT (Prescott)—Treating dump and handling 60 tons daily. Tiger mine tailings also being treated.

BLACK DIAMOND (Walker)—Ordered new machinery, including compressor and steam-power drilling plant.

ARKANSAS

Marion County

MONKEY HILL (Flippin)—Under operation by Central States Lead and Zinc Co. Sinking shaft for ventilation and ore hoisting. Work showing orebody of jack.

HAWKE-EYE (Rush)—The 50-ton Joplin-type plant under construction for last four months was put in operation recently.

DRY MILL (Yellville)—The Sutton, Steel & Steel dry process mill, completed several months ago, given test run on ore from Paradise mines. Test was satisfactory.

LUCKY DUKE (Yellville)—Starting active mining. Produces zinc carbonate and lead ores.

Newton County

BIG JOE (Everton)—Has installed two tractors and trailers to move zinc production for shipment.

CALIFORNIA

Butte County

CHROME DEPOSIT of large size reported at Intake on Western Pacific Ry. Cropping indicating ledge formation and extending over width of 60 ft. has been traced 1200 feet.

Calaveras County

CHROME MINING active in Campo Seco district. Much ore is high grade. Concentrating mills contemplated.

CHROME ORE mined and shipped from region of Copperopolis is packed on animals or hauled in motor trucks about 17 miles to Milton, on Southern Pacific. Miners asking railroad for better loading facilities.

PENN COPPER (Campo Seco)—Maintaining large copper yield. Good ore in lower levels.

Inyo County

TOMBOY (Lone Pine)—New lead-silver property opened recently promises to become a producer. Shaft is down 50 feet.

COLORADO

Boulder County

MOLTKE (Brainerd Camp)—Lease secured by F. H. Cobb; to resume development. Sampling indicates reserve of 100,000 tons of silver-lead ore.

BURLINGTON-BOULDER (Sunshine)—Adit on Taurus vein advanced to length of 700 ft. and to be advanced 250 ft. more. An orebody opened near present breast of adit and a raise is being made. To connect with bottom of discovery shaft. Crosscut to prospect parallel veins.

Clear Creek County

CONSOLIDATED MINES (Alice)—Recent development opened ore. Contract let for new mill. Machinery ordered. Plant hoped to be ready first of September.

COLORADO CENTRAL (Georgetown)—Flotation plant completed. To treat ore from Equator and Ocean Wave mines and from Marshall dumps.

KELSO MINING (Georgetown)—Properties in the Argentine mining district secured under lease by R. R. Wheeler. Development to be resumed soon.

SANTIAGO (Georgetown)—High-grade ore opened by development under direction of Joseph Campbell.

ARGO MILL (Idaho Springs)—During first twelve days of July the following shipments were received from lessees operating near-by mines: Hawquist & Co., Gem mine, 11 tons; Columbia Leasing Co., Gem mine, 50 tons; Fred Weeden, 5 tons; Tremont Mining Co., 75 tons; Tremont Mining Co., from Concrete mine, 50 tons; Joe Reese, Pewabic mine, 25 tons; Frontenac mine, 25 tons; Chris Stangier, Windsor Castle mine, 25 tons; O. C. Redeck, Bryant tunnel, Black Hawk, 25 tons; Johnson & Jenkins, Poso mine, 25 tons; Alvin Clark, Homer mine, Central City, 25 tons; Cooper Brothers, Lord Byron mine, 25 tons.

San Juan County

EARLY BIRD (Animas Forks)—A 6-ft. vein of gold-silver-lead ore opened in new crosscut tunnel. Considerable new development contemplated. C. B. Blitzkie is manager.

TELESCOPE (Chattanooga)—Developed successfully by the Telescope Mining and Milling Co. B. F. Majors is superintendent. Carload trial shipment of ore from main tunnel made to Durango smeltery. Regular shipments contemplated.

JOE AND JOHN (Gladstone)—Workings being retimbered, and development in progress. E. W. Walter, of Silverton, is manager.

MINNEHAHA (Gladstone)—Acquired by the new Minnehaha Mining and Milling Co. George Bibb, of Silverton, is manager. Active development to be undertaken soon.

KOEHLER TUNNEL (Red Mountain)—Active development to be undertaken soon.

BULLION KING (Silverton)—Property in Porphyry Basin secured under lease by local operators. Mine buildings and compressor to be repaired; tunnel retimbered, and development work resumed soon. Has produced high-grade lead-silver ore.

San Miguel County

SILVER CHIEF (Telluride)—Workings being repaired preparatory to examination and resumption of development. W. H. Trout is manager.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Building drydock at Torch Lake for big Bucyrus dredger, which handles tailings for regrinding mills.

SENECA (Calumet)—Vertical shaft was sunk 99 ft. during first half of July.

QUINCY (Hancock)—Slight fire at No. 2 shaft night of July 12 extinguished in few hours; origin not incendiary.

HOUGHTON (Houghton)—Third lode 80 ft. from west vein of Superior lode; if it has extent will make mine of property.

WINONA (Winona) — Good ground opened in 15th level drift driven under King Philip shaft No. 1.

NEVADA

Humboldt County

ROCHESTER COMBINED MINES (Rochester)—Development work progressing and 200,000 tons ore blocked out. Main tunnel cuts vein at depth of 320 ft. New mill almost completed.

RYE PATCH (Winnemucca)—Operated by American Mining and Exploration Co. and now shipping 50 to 75 tons ore per day. Imlay mine also being operated, and shipments to be made soon.

Lander County

RUBY GROUP (Battle Mountain)—Cinnabar property 20 miles from Bridges on Nevada Central R. R. sold recently by local men to John Ross. Price stated $50,000. Development work to begin at once.

Lyon County

NEVADA - DOUGLAS (Ludwig) — Big square-set stope with area of about 60 by 200 ft. caved July 14th; no loss of life. Loss serious and considerable time and expenditure will be required to reopen.

McCONNELL (Mason)—Regular shipments being made.

WESTERN NEVADA (Mason)—Opening up shipping-grade copper ore in new territory. Subsidiary Nevada-Douglas Copper Company.

BLUE JAY (Yerington)—Reopened by lessees, and good ore being mined from surface.

Mineral County

GOLD STRIKE IN PAMLICO DISTRICT recently made. Prospect being opened for copper ore when shoot of quartz showing much free gold was broken into.

WALL STREET (Luning)—Shipments by burro and wagon of 30 to 40 tons high-grade copper ore daily.

DUNLAP (Mina)—Siliceous ore with good copper oxide content being broken on surface.

OLYMPIC MINES (Mina)—Mill running steadily on good gold ore, but at reduced capacity, on account of water shortage. All-sliming cyanide process used. Fred Selbert is manager.

SIMON LEAD (Mina)—Shaft sinking continued; now down 250 ft. Heavy lead-zinc ore opened.

TAFT (Mina)—Lessees shipping copper ore.

Nye County

MANHATTAN CONSOLIDATED (Manhattan)—Ore being tested at Goldfield Consolidated mill. Discovery of high-grade free-milling gold ore in shoot 3 to 8 ft. wide and 40 ft. long made recently in raise from third level. Development in ore under way on 5th level.

CONSOLIDATED MAYFLOWER (Pioneer)—Mill dropping 10 stamps. Power furnished by oil engine; and water pumped from mine. Development work opened large tonnage of gold ore. Drift being driven on 300-ft. level.

TONOPAH JUPITER (Tonopah)—Shoot of lead-silver ore opened at depth of 130 ft. in shaft sinking.

WEST END CONS. (Tonopah)—Motor to haul ore from Ohio section of mine to West End shaft to be installed. Other hauling facilities to be improved, cutting down number of men necessary.

Storey County

NORTH END MINES (Virginia City)—Unwatering progressing satisfactorily, and also development work. High-grade silver ore opened recently.

NEW MEXICO

Grant County

GREAT EAGLE (Lordsburg)—Negotiations on for purchase from Cauthon & Connors by interests represented by A. Interreiden of 85 Mine. Price asked $300,000 net cash. Owners estimate 800,000 tons high-grade fluorspar ore.

MISER'S CHEST (Lordsburg)—Randell & Crocker ceased work until questions regarding terms of lease are adjusted with owner, James Berryhill, of California.

AJAX COPPER (Rodeo) — Installing 300-cu. ft. compressor. To remodel 200-ft. shaft to meet Arizona law requirements.

HILL-TOP METAL (Rodeo)—Continues to show good lead-silver orebodies in 3000-ft. tunnel. Crosscuts being driven on one of largest bodies. No. 2 tunnel is in 1700 ft.; to be carried 700 ft. further. No. 3 tunnel is in 900 ft. R. O. Fife is superintendent.

KING COPPER (Rodeo)—Sinking Ainsworth shaft at 100 ft. opened body of good copper-sulphide ore. C. E. Welch is superintendent.

KING OF LEAD (Rodeo)—Under negotiations with James P. Porteus, Lordsburg, N. M., for California parties.

BRADFORD & CLOUDMAN (Steins)—Shipped four cars silver-lead ore to El Paso smeltery. To install machinery later.

McGEE BROS. (Steins)—One test car silver-lead ore ready to ship. Charles McGee is superintendent.

SILVER BELL NO. 1 (Steins)—Tregear & Connolly, owners, have car gold-silver ore ready to ship.

BURRO MOUNT. COPPER (Tyrone)—Three cars per week of fluorspar being shipper by Contractor O'Brien.

OREGON

Jackson County

E. W. SHATTUCK (Applegate)—Uncovered gold ore at Thompson Creek mine.

ANDERSON (Gold Hill)—Gold mine, situated in the Ashland and Shorty Hope group, on Wagner Creek south of Talent, sold to Seattle men for $30,000 on 60-day option.

Josephine County

HOLTER & FAUCHE (Grants Pass)—Developing leased chrome deposit in Williams Creek district and building auto road.

CHARLES OWENS (Grant Pass)—Developing chrome ore on Sucker Creek, in Illinois district, and hauling by trucks to Waters Creek for shipment.

R. A. SPENCER (Grants Pass)—Developing chrome deposit on Briggs Creek and building a road. Rich ore now packed by mules eight miles.

R. G. ADAMS MAGNESITE CO. (San Francisco, Calif.)—Mining chrome ore on High Plateau deposits near California-Oregon line.

SOUTH DAKOTA

Pennington County

INGERSOLL (Keystone)—Taken over by W. T. McCaskey, of Moloney Blue Co., and J. E. Carter, of New York. To work for lithia minerals. Ores carry amblygonite, lapidolite, spodumene, columbite and mica. Machinery to be installed soon.

MOLONEY BLUE (Keystone)—Shipped nine cars ore during June to Omaha smeltery. W. T. McCaskey is president.

UTAH

Beaver County

CROFT MINING (Milford)—Taken under bond and lease by neighboring Stampede Co. at price of $100,000 if paid in one year, and increasing by $10,000 yearly if payment is delayed. B. F. Caffey and R. H. Strickland interested.

Juab County

TINTIC SHIPMENTS week ended July 13 amounted to 132 cars.

TINTIC STANDARD (Eureka)—Production continuing at high rate, but hampered by labor shortage.

Salt Lake County

CAMP OF ALTA, in Little Cottonwood Canyon, is shipping 1000 to 1500 tons weekly. Shippers are South Hecla, two to three cars a day; Michigan-Utah, about two cars daily; Columbus-Rexall, 35 to 40 tons. The Sells, Alta Consolidated, Peruvian, Wasatch Mines, Alta Consolidated, Alta-Michigan and Emma Consolidated are also shipping.

Summit County

PARK CITY SHIPMENTS week ended July 13 were 3,819,685 lb. of ore and concentrates.

DALY-WEST (Park City)—Connections being made between shaft and Daly-Judge tunnel. Mill working three shifts on tailings from dump.

PARK-UTAH (Park City)—Work being done in both north and south drifts from tunnel. Ground difficult to work and labor shortage felt.

GLEN-ALLEN (Park City)—Formerly Glencoe. New machinery on ground and work to be speeded up.

Utah County

BELOROPHON (American Fork)—Mill completed. Has blocked out 10,000 to 11,000 tons of low-grade ore, and mill expected to produce 10 to 15 tons concentrates daily.

PACIFIC (American Fork)—Mill of leasing company producing steadily. Capacity 150 tons daily. Auto truck installed for haul down American Fork Canyon.

WASHINGTON

Spokane County

SPOKANE TIN AND TUNGSTEN (Moran)—Incorporated by F. C. Bailey and F. A. Ross, Spokane. Doing preliminary work on tin property 10 miles south of Spokane.

Stevens County

NORTHWEST MAGNESITE (Cnewelah)—Installed 300-hp. gasoline motor to supplement power. Installing two calcining kilns. R. B. Rogers is superintendent.

QUEEN (Deer Trail)—Expects to begin shipments soon.

SEAL (Deer Trail)—J. Van Horn and brother taken lease and to begin shipping at once.

O-LO-LIM (Spokane Indian Reservation)—Begun small shipments copper ore. Has 25-year lease from Indian Department.

CLEVELAND (Springdale)—Santa Rita Mining Co., organized by Robert Sweeny, has purchased property and begun work. Workings 100 ft. deep show orebody 12 to 15 ft. wide.

CANADA

British Columbia

SILVERSMITH (Slocan) — Strike of high-grade orebody 9 ft. wide. Formerly the Slocan Star.

WAKEFIELD (Slocan) — Acquired by Clarence Cunningham. Shipping Queen Bess and Van Roi ore to Trail smeltery.

Ontario

CASTEL (Gowganda)—Shaft is down 150 ft., at which point geological conditions were favorable and will be sunk to 350 ft. to reach contact of diabase and Keewatin.

WALSH (Gowganda)—Shaft sunk to 200 level, where crosscut being driven.

McINTYRE (Porcupine) — Developing New Ray property under option, work being on 400 level.

NORTH DAVIDSON (Porcupine)—Option to Apex extended two months. Another diamond drill hole to be sunk.

PORCUPINE CROWN (Porcupine)—Closed indefinitely. Supplies being sold.

THOMPSON-KRIST (Porcupine)—Contract for 500 ft. drifing let to the Vipond.

McKINLEY-DARRAGH (Cobalt)—Large amount of ore being treated from old workings of the Savage, which had been left because its extraction was unprofitable before the rise in the price of silver.

MINING CORPORATION (Cobalt)—Pumps for handling old tailings for retreatment have arrived. Capacity of mill, 300 tons ore per day, but with new plant in operation is expected to treat only 100 tons ore per day and 500 tons old tailings.

PENN-CANADIAN (Cobalt)—Purchased control of Peninsula Mining Co., owner of St. Maurice molybdenum property in Quebec. A mill to be started immediately.

PETERSON-LAKE (Cobalt)—Flotation plant closed to make changes to increase capacity.

WRIGHT-HARGRAVES (Kirkland Lake)—Underground work stopped. Sufficient ore to justify mill, but probably will not be erected until after war.

MILLER - INDEPENDENCE (Boston Creek)—To install 7-drill compressor to enable more comprehensive development.

ONTARIO WESTERN (Boston Creek)—A number of promising veins uncovered and two prospecting shafts to be sunk.

GRAHAM-HORNE-TAYLOR (Lightning River)—A discovery of gold has been made adjacent to the Howie-Couchenour-Williams group.

The Market Report

SILVER AND STERLING EXCHANGE

July	Sterling Exchange	Silver New York, Cents	Silver London, Pence	July	Sterling Exchange	Silver New York, Cents	Silver London, Pence
25	4.7530	99⅛	48 11/16	29	4.7530	99⅛	48 11/16
26	4.7530	99⅛	48 11/16	30	4.7530	99⅛	48 11/16
27	4.7530	99⅛	48 11/16	31	4.7530	99⅛	48 11/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

July	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
25	*26	†	8.05	7.75	8.05 @8.15
26	*26	†	8.05	7.75	8.05 @8.10
27	*26	†	8.05	7.75	8.05 @8.10
29	*26	†	8.05	7.75	8.00 @8.05
30	*26	†	8.05	7.75	8.00 @8.05
31	*26	†	8.05	7.75	7⅞ @8

*Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917, and July 2, 1918.

† No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

July	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
25	122	122	137	380	380	29½	28½	54
26	122	122	137	380	380	29½	28½	54
27	...	...	...	...	...	...	...	...
29	122	122	137	385	385	29½	28½	54
30	122	122	137	388¼	388¼	29½	28½	54
31	122	122	137	390	390	29½	28½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515: £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—July 31, 1918

The metal markets were destitute of new features of special interest during the last week.

Copper—The great subject of interest is the forthcoming meeting between the producers and the Price-Fixing Committee of the War Industries Board to settle upon the price for copper after Aug. 15. Although the advance to 26c. on July 2 pleased the producers, it is recognized that the increment did nothing but offset increased costs of production, freight rates, etc., and did not in itself afford any stimulus to increased production, which is greatly needed.

Copper Sheets are not quoted, as there is a wide diversity in prices of different dealers. Copper wire is quoted at 29 to 30c. per lb. f.o.b. mill, carload lots.

Tin, Lead, and Zinc

Tin—The local market does not respond to the increased price abroad and is rather quiet. There is not much tin here, and local buyers are getting all that they need or have stocked up and are holding off. Straits tin was quoted in New York on July 25 and 26 at £377, c.i.f. London; on the 29th at £383; on the 30th at £384 and on the 31st, at £386.

Lead—The situation is ominous, and consumers are in despair. The quoted prices establish the terms of settlement for lead that is being produced and consigned on contract, but nobody can obtain any lead in the market at the prevailing prices, for free lead does not exist. The only alternative for manufacturers who need lead not arranged for previously, and now find themselves unable to get it, is to close their plants. Cases of this have already happened, even in such important matters as the manufacture of shrapnel bullets. The Government is requiring a great deal of lead for chemical construction, and apparently has new plans on foot. The shortage of chemical lead is acute, and rolling-mills that ought to be at work in producing that class of sheet have had to be switched to other work. The situation in lead promises to become worse before it will begin to be better, even if the recent rate of production be maintained. If production falls off it will be almost a calamity. The most important thing is to strain every nerve to increase production.

Zinc—This market continues dull and uninteresting. Producers are rather puzzled, for the statistics for the second quarter were regarded favorably, and it was thought probable that upon their showing the market would exhibit some life.

Zinc Sheets—Unchanged at $15 per 100 lb., less usual trade discounts and extras as per list of Feb. 4.

Other Metals

Aluminum—Price fixed at 33c. per lb. for lots of 50 tons or more, ingot, 98-99% grade. Sheets are 42c. per lb. for 18 gage and heavier. Price established June 1 and continues to Sept. 1.

Antimony—The market is quiet but strong in futures. We quote spot at 13 to 13½c., and futures at 11½@12c., c.i.f., in bond.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted $1.50@1.75 per pound.

Nickel—Market quotation is 40@45c. per pound.

Quicksilver—Steady at $125, San Francisco reports, by telegraph, $117, firm.

Consumers report inability to obtain supplies of metal. One of them, last week, requested the authorities at the Mare Island Navy Yard to send him immediately 500 flasks, and received the reply that they were unable to collect anywhere near that quantity. He considered this strange, in view of the fact that most of the producers at the recent hearing of the Tariff Commission in San Francisco reported that their cost of production is only $70@$75, and the Government price is $105, which affords a reasonable margin of profit. The consumer, in conversation, explained that the theoretical margin is undoubtedly large enough, but that in his opinion the extreme delay between delivery of metal and receipt of payment from the Government is responsible for the inability to obtain supplies. Most of the quicksilver producers are small concerns or individuals. The small producer is like the man of small salary. He lives more or less from hand to mouth, and his continuous operation demands prompt receipt of the funds becoming due him. One concern reports being many weeks behind in settlements for shipments. To a big company this may not be a serious matter, but the small operator has to have prompt cash in order to meet his payroll.

Gold, Silver and Platinum

Gold—Imports of gold during the fiscal year amounted to only $124,000,000, as compared with $977,000,000 in 1917; exports were valued at $191,000,000, compared with $292,000,000 in 1917.

Silver—The silver situation remains unchanged, with quotations established in London at 48 1/16d. and in New York at 99⅛ cents.

Silver imports amounted to $70,000,000 in 1918, against $35,000,000 in 1917, and silver exports increased from $78,000,000 in 1917 to $139,000,000 in 1918.

China exchanges continue high and at a level to permit bids over the Government price of $1 per oz., but difficulty in obtaining Federal license to export is restricting buying for China account. Exports of silver from New York to London for week ending July 27 amounted to 822,000 ounces.

Mexican dollars at New York: July 25, 77; July 26, 77; July 27, 77; July 29, 77; July 30, 77; July 31, 77.

Platinum, Palladium, and Iridium—Prices fixed at $105, $135 and $175, respectively.

The War Industries Board asserts that there is platinum enough. The fact that none is purchasable at less than $105 indicates the contrary. It is said that $125 could easily be realized in the trade. We hear rumors, via England, of clandestine transactions around that figure in this market.

Zinc and Lead Ore Markets

Joplin, Mo., July 27—Blende, per ton, high, $77.60; basis 60% zinc, premium, $75; Class B, $65@60; Prime Western, $50@45; calamine, basis 40% zinc, $37.50 @30. Average selling prices: Blende, $56.25; calamine, $37.20; all zinc ores, $55.59 per ton.

Lead, high, $104.10; basis 90% Pb, $102 @100; average selling prices all grades of lead, $99.68 per ton.

Shipments the week: Blende, 7676; calamine, 294; lead, 1023 tons. Value all ores the week, $544,870.

A peculiar situation, much resembling a panic, occurred this week. On Thursday sellers seemed firm for an unchanged or upward market. Friday morning's papers published rumors concerning the Government taking over the interests of the American Metal Company, and Friday afternoon this company was getting more offers of ore than it could take on $47.50 base and had to reduce the level to $45, at which figure several hundred tons were secured. Today, apparently satisfied that this company is still wanting ore, the market again strengthened.

Platteville, Wis., July 29—Blende, basis 60% zinc, highest price reported paid for premium grade was $75.30 per ton; high lead blende, $52 per ton base; lead ore, basis 80% lead, $90 per ton base. Shipments reported for the week were 2568 tons blende, 40 tons galena and 978 tons sulphur ore. For the year to date the figures are 75,308 tons blende, 4240 tons galena and 29,804 tons sulphur ore. During the week 3552 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—Ore of 40% grade quoted at $1.40 per unit, f.o.b., California, with 50% low silica chrome offered at $1.70 per unit.

Manganese Ore—Charles Hardy says under date of July 30: "The high prices fixed by the Government, which also allows a delivery of manganese ore containing a high percentage of silica, have brought out so much manganese ore that most of the users have been flooded with supplies and some of the principal users have withdrawn from the market for the time being, as they receive a sufficient quantity under contract, and do not bid for isolated lots now. On the other hand, good-grade ore, low in silica, still finds a ready market at the prices fixed by the Government."

Molybdenum Ore—Situation remains almost unchanged, with no new business to speak of; price is nominally around $1 per unit for ore containing 90% or over.

Tungsten—The market for high-grade ores is active, prices of $24 being paid for scheelite, 70% and over, and $24 for the highest grade wolframite. Ordinary high grades brought $22.50 to $23.50 per unit; low-grade ores $18, on the basis of 65 per cent.

Other Minerals

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight. Tonnage is extremely difficult to obtain. Domestic pyrites is selling at a price of 25c. per unit, f.o.b. mine, according to delivery basis. Some mines in the South are reporting prices as 34c. per unit for lump and 32c. per unit for fines, f.o.b. mine.

Iron Trade Review

NEW YORK—July 31

A conference in New York Monday between Government leaders in shipbuilding, the Director of Steel Supply and the steel manufacturers' committee had to do with means of increasing the allotment of steel to shipyards, in view of the enlarging program for the Schwab drive, says "Iron Age." At a meeting in Washington later in the week, plans will be made to insure shipyard work against interruption in the coming year, also for the prevention of lost motion through competing efforts of Washington departments, the commanding general in France and the Allies.

The whole tenor of the conference talk was that, however detailed figures might be changed, the main fact was the increasing war demand for steel and with it an indefinite but inevitable reduction in the amount available for other uses.

The large schedules of steel for direct and indirect war needs give weight to the claim still widely made that all Governmental agencies concerned have put their requirements at top figures, in spite of repeated requests for pruning. In short, if deliveries meet schedule figures, it is believed the reservoir would be an ever-filling one, unless the talked-of railroad breakdown should be really serious. The half-year's demand for shell steel has risen to 3,000,000 tons, requiring a shipment rate probably 15% above that now obtaining, and the plate total is close to theoretical capacity and about 12% more than the recent record outputs.

The Steel Corporation's net earnings of $62,500,000 in the second quarter, plus nearly $91,000,000 set aside for Federal taxes, make a total 70% greater than a similar total for the first quarter, with its drastic shutdowns in January and February. The exhibit, even with the lavish allowance for war taxes, is striking testimony to the earning power of a great integrated producer on the present scale of Government-made prices. Evidently the quarter included some deliveries at the higher prices ruling before steel control set in last September.

The 10% wage increase announced by the Steel Corporation was a surprise to the independent companies, from which like action may be expected, as heretofore. Five other 10% advances in the past 30 months and one of 15% make the new wage 103% higher than that paid on Jan. 1, 1916. The Steel Corporation pace of wage increase adds to the problem of some small producers, who are pinched by Government prices on which the corporation can make large profits.

Washington has come to the help of the jobbers, many of whom were left with small stocks owing to poor deliveries in recent months. For August the Director of Steel Supply permits them to receive from the mills shipments equal to their average in the first six months of the year. Beginning with September, however, the War Industries Board's plan becomes effective, permitting the replacement each month of the amount shipped by the jobber from stock for Government and essential purposes in the preceding month.

PITTSBURGH

The usual Pittsburgh letter had not been received up to the time of the Journal's going to press.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861	88.082	27.597	36.410	43.620
April	64.415	73.875	95.340	30.662	36.963	47.215
May	74.269	74.745	99.505	35.477	37.940	48.980
June	65.024	76.971	99.500	31.060	39.065	48.875
July	62.940	79.010	99.625	30.000	40.110	48.813
Aug.	66.083	85.407		31.498	43.418	
Sept.	68.515	100.740		32.584	50.920	
Oct.	67.855	87.332		32.361	44.324	
Nov.	71.604	85.891		34.192	43.584	
Dec.	75.765	85.960		36.410	43.052	
Year	65.661	81.417		31.315	40.851	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23.500	131.921	110.000	142.895	125.000
Feb.	31.750	23.500	137.895	110.000	148.100	125.000
Mar.	31.481	23.500	136.750	110.000	151.000	125.000
April	27.935	23.500	133.842	110.000	147.158	125.000
May	28.788	23.500	130.000	110.000	142.000	125.000
June	29.962	23.500	130.000	110.000	142.000	125.000
July	26.620	25.904	128.409	119.913	140.409	134.913
Aug.	25.380		122.391		137.000	
Sept.	25.073		117.500		135.250	
Oct.	23.500		110.000		125.000	
Nov.	23.500		110.000		125.000	
Dec.	23.500		110.000		125.000	
Year	27.180		124.892		138.401	

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293.227
February	51.420	92.000	198.974	311.525
March	54.388	(a)	207.443	318.875
April	55.910	(a)	220.171	329.405
May	63.173	(a)	245.114	364.217
June	62.053	(a)	242.083	331.925
July	62.570	(a)	242.181	360.347
August	62.681		243.978	
September	61.542		244.038	
October	61.851		247.467	
November	74.740		274.943	
December	87.120		298.556	
Av. year	61.802		237.563	

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199	7.201	9.120	7.091	30.500	29.50
April	9.288	6.772	9.158	6.701	30.500	29.50
May	10.207	6.818	10.202	6.704	30.500	29.50
June	11.171	7.611	11.123	7.511	30.500	29.50
July	10.710	8.033	10.644	7.750	30.500	29.50
August	10.594		10.518		30.500	
September	8.680		8.611		30.500	
October	6.710		6.650		30.500	
November	6.249		6.187		30.500	
December	6.375		6.312		30.500	
Year	8.787		8.721		30.500	

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	6.810	9.289	6.71	54.632	54.000
May	9.362	7.314	9.192	7.114	54.000	54.000
June	9.371	8.021	9.201	7.791	54.000	54.000
July	8.643	8.373	8.473	8.338	54.000	54.000
August	8.360		8.190		54.000	
September	8.136		7.966		54.000	
October	7.983		7.813		54.000	
November	7.847		7.672		54.000	
December	7.685		7.510		54.000	
Year	8.901		8.813		52.413	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35.95	$37.25	$30.95	$33.95	$30.95	$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37	37.25	33.49	33.95	35.91	33.95
April	42.23	36.15	38.90	32.95	40.06	33.95
May	46.94	36.20	42.84	33.00	43.60	34.00
June	54.22	36.36	50.05	33.16	50.14	34.16
July	57.45		53.80		53.95	
August	54.17		50.37		53.95	
September	46.40		42.24		48.58	
October	37.25		33.95		33.95	
November	37.25		33.95		33.95	
December	37.25		33.95		33.95	
Year	$43.57		$39.62		$40.83	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	July 30
Alaska Gold M.	3⅛
Alaska Juneau	2⅛
Am.Sm.& Ref.,com.	77⅛
Am. Sm. & Ref., pf.	106
Am. Sm. Sec., pf., A	88⅛
Am. Zinc	19
Am. Zinc, pf.	49½
Anaconda	65⅛
Batopilas Min	1⅛
Bethlehem Steel	83⅛
Bethlehem Steel, pf.	‡88½
Butte & Superior	28⅛
Butte Cop. & Zinc	11⅛
Cerro de Pasco	34
Chile Cop.	16½
Chino	39
Colo.Fuel & Iron	46
Crucible Steel	66⅛
Crucible Steel, pf.	90⅛
Dome Mines	9⅛
Federal M. & S.	10
Federal M. & S., pf.	33
Great Nor., ore ctf.	31⅛
Greene Cananea	44⅛
Gulf States Steel	81⅛
Homestake	72
Inspiration Con.	52⅜
InternationalNickel	30
Kennecott	33⅛
Lackawanna Steel	82
Mexican Petrol	99⅞
Miami Copper	29⅛
Nat'l Lead, com.	58⅛
National Lead, pf.	101
Nev. Consol.	20
Ontario Min	10⅛
Ray Con	24
Republic I.&S.,com.	91
Republic I. & S., pf.	100⅛
Sloss-Sheffield	61⅛
Tennessee C. & C.	19½
U. S. Steel, com.	107⅞
U. S. Steel, pf.	111⅛
Utah Copper	81⅛
Va. Iron C. & C.	72

BOSTON CURB*	July 30
Alaska Mines Corp.	.12
Boston Ely	.75
Boston & Mont.	.51
Butte & Lon'n Dev.	.15
Calaveras	.50
Calumet-Corbin	‡.01
Chief Con.	2⅛
Cortez	.05
Crown Reserve	.19
Crystal Cop.	.23
Eagle & Blue Bell	2⅛
Gila Copper	‡17
Houghton Copper	.50
Intermountain	‡.05
Iron Cap	18⅛
Mexican Metals	.45
Mines of America	1⅛
Mojave Tungsten	.10
Nat. Zinc & Lead	18
Nevada-Douglas	.52
New Baltic	.90
New Cornelia	18⅛
Oneco	.20
Pacific Mines	‡.35
Rex Cons	.07
Yukon Gold	1

SAN FRAN.*	July 29
Alta	‡.03
Andes	‡.05
Best & Belcher	‡.03
Caledonia	‡.03
Challenge Con.	‡.03
Confidence	‡.04
Con. Virginia	.26
Gould & Curry	‡.01
Hale & Norcross	‡.01
Jacket-Cr. Pt.	.06
Mexican	.20
Occidental	‡.51
Ophir	.06
Overman	‡.02
Savage	‡.03
Sierra Nevada	‡.09
Union Con.	.38
Utah Con.	‡.01
Belmont	2.75
Jim Butler	.59
MacNamara	.31
Midway	.04
Mont.-Tonopah	.10
North Star	.06
Rescue Eula	.10
West End Con.	1.02½
Atlanta	.03
Booth	.04
Comb. Frac.	.02
Florence	.10
Jumbo Extension	.10
Kewanas	.04½
Nevada Hills	.01
Nevada Packard	‡.27
Round Mountain	‡.18
Silver Pick	.04
White Caps	.30
Big Jim	‡.75
United Eastern	3.50

COLO. SPRINGS*	July 22
Cresson Con.	4.68½
Doctor Jack Pot	.03½
Elkton Con.	.04
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.64½
Granite	.18
Isabella	.04½
Mary McKinney	.05
Portland	.80
United Gold M.	.13
Vindicator	.30

BOSTON EXCH.*	July 30
Adventure	.50
Ahmeek	.75
Algomah	‡.15
Allouez	50½
Ariz. Com., ctfs.	14½
Arnold	.20
Bingham Mines	9⅛
Bonanza	.15
Butte-Balaklava	.25
Calumet & Ariz.	68½
Calumet & Hecla	450
Centennial	13
Copper Range	48
Daly West	2⅛
Davis-Daly	6
East Butte	9⅛
Franklin	4⅛
Granby	78
Hancock	6
Hedley	‡12
Helvetia	.15
Indiana	‡.40
Isle Royale	26
Keweenaw	1
Lake	5⅛
La Salle	2⅛
Mason Valley	4
Mass	5⅛
Mayflower	2⅛
Michigan	2⅛
Mohawk	57
New Arcadian	1⅛
New Idria	14
North Butte	14⅛
North Lake	.65
Ojibway	.40
Old Dominion	42
Osceola	51
Quincy	68
St. Mary's M. L.	52
Santa Fe	.65
Seneca	11
Shannon	4⅛
Shattuck-Ariz.	16
So. Lake	1
So. Utah	.13
Superior	‡4⅛
Superior & Bost.	2⅛
Trinity	3
Tuolumne	.97
U. S. Smelting	42
U. S. Smelt'g, pf.	43⅛
Utah Apex	2⅛
Utah Con.	10
Utah Metal	2
Victoria	2⅛
Winona	1⅛
Wolverine	27
Wyandot	.50

N. Y. CURB†	July 30
Big Ledge	1⅛
Butte & N. Y.	.75
Butte Detroit	.16
Caledonia	.45
Calumet & Jerome	1⅛
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	.05
Con. Ariz. Sm.	1⅛
Con. Coppermines	‡5⅛
Con. Nev.-Utah	‡⅛
Emma Con.	.10
First Nat. Cop.	2
Goldfield Con.	.24
Goldfield Merger	.03
Greenmonster	2⅛
Hecla Min	4⅛
Howe Sound	‡4⅛
Jerome Verde	⅛
Kerr Lake	5.60
Louisiana	⅛
Magma	‡32
Majestic	.18
Marsh	‡.05
McKinley-Dar-Sa.	.38
Milford	‡.75
Mohican	.06
Mother Lode	.36
N. Y. & Hond.	‡12½
Nipissing Mines	8½
Nixon Nevada	.51
Ohio Cop.	1⅛
Rawley	‡2⅛
Ray Hercules	4⅛
Richmond	‡.56
Rochester Mines	.38
St. Joseph Lead	14⅛
Standard S. L.	1
Stewart	‡.17
Success	‡.10
Tonopah	2⅛
Tonopah Ex.	1⅛
Tribullion	⅛
Troy Arizona	.12
United Cop.	⅛
United Verde Ext.	37½
United Zinc	1⅛
Utica Mines	‡.08

TORONTO*	July 30
Adanac	.07½
Bailey	.03
Beaver Con.	.23
Chambers Ferland	.12
Coniagas	2.50
Hargraves	.04
La Rose	.35
Peterson Lake	‡.09½
Temiskaming	.30
Wettlaufer-Lor.	.04
Davidson	‡.35
Dome Exten.	.10
Dome Lake	.12
Hollinger	4.50
McIntyre	1.28
Newray	.12
Porcu. Crown	.10
Teck-Hughes	.14
Vipond	.12
West Dome	.09

* Bid prices. † Closing prices. ‡ Last Quotations.